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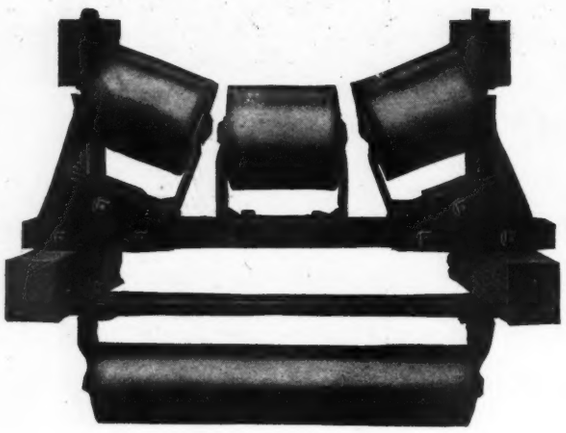

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FIG. 1. PALMA RANCHO AT SAN AUGUSTIN, WITH "SALTPETER WORKS" IN REAR

Saltpeter in Guatemala

BY HOYT S. GALE

The making of saltpeter, or nitrate of potassium, termed "salitre" in Spanish, is an old industry among the natives in various parts of Guatemala. It is not known when or how this industry started, but the suggestion has been advanced that, as the use of gunpowder made from saltpeter is so closely identified with religious ceremonies among the Guatemalans and similar native races, the technique of its manufacture may have been brought by the early churchmen from the Old World. Saltpeter is made in Guatemala from the leachings of soils about the native villages, the work of separating and refining this salt being performed mostly by women. The amount of saltpeter produced in this way is small.

CRUDE fireworks made from the old-fashioned black powder are employed almost universally among the Central and South American native races as an accompaniment to the celebration of festivities and ceremonials of all kinds, and the opportunity for their use is frequent. The popping and banging of *cohetillas*, which are a kind of firecracker; *bombas*, and *quetas*, which are bombs or rocket-like affairs made of bamboo canes in the shape of an ordinary skyrocket, may be heard almost daily in many of the larger towns or cities.

Most of the powder employed in the manufacture of these fireworks is made from saltpeter produced locally, combined with native sulphur and ordinary charcoal. The quantities of such powder made locally must be considerable, judging from its almost constant use. but no statistics showing the amount are available.

The handling and use of explosives, including the manufacture of black powder and of saltpeter, are under strict governmental control in Guatemala. The making of saltpeter is commonly referred to as a government monopoly, as each operator in this industry is required by law or regulation to obtain a license. The cos of such license was said, in July, 1917, to be 5 pesos (about 12½c. U. S. money) a month. Another requirement was that all the saltpeter made must be delivered to the Administrador de Rentas in each department or province, by whom a price fixed by the government is paid. Only one grade is recognized officially, namely the best grade of refined saltpeter made locally, but the purity of the native product varies greatly. In 1917 the price paid by the government was stated to be 3 pesos (about 7½c. U. S. money) per lb., for the refined saltpeter crystal.

Reports of the making of saltpeter have come from various parts of Guatemala. Special attention has, however, been directed of late to the production at the little town of San Augustin, in the Department of Progreso, and at other places near by in the valley of the Motagua River. This includes a small production apparently made intermittently in the towns of El Rancho and Zacapa, and possibly in other neighboring settlements. Production has also been reported in other parts of the country, at Antigua, Occidente, and in the neighborhood of Totonicapan, which is 15 or 20 miles northeast of Quezaltenango. Less definite reports state that saltpeter is also made "somewhere beyond Tacana, down on the Pacific Coast."

Saltpeter Manufactured During Dry Season

The procedure followed in the manufacture of saltpeter at San Augustin is essentially the same as that at other places in the country. Its manufacture is carried on principally in the dry season, which usually extends from November to May. My visits to San Augustin were made in the latter part of July, 1917, and were thus in the rainy season. Heavy showers occurred frequently, usually every afternoon or night, although occasionally it did not rain for two or more consecutive days. As these rains are usually torrential, and drench the soil, they wash away most of the soluble salts from the surface; but as soon as the ground begins to dry again there are many places in which an efflorescence of salts may be found. The crops of such salts are undoubtedly much more abundant in the dry season than during the rains.

The most surprising point developed by the inquiry into the Guatemalan saltpeter industry is the detail and exactness with which the different steps of the process are carried out. Knowledge of the details apparently has been handed down from generation to generation as a family inheritance, and with most of its possessors this knowledge is guarded jealously as a family secret. In almost every case the operators are the women of the family.

The view given in Fig. 1 shows a typical native hut in San Augustin, with the "saltpeter works" in the rear. The leaching and boiling are done under the shelter of a thatched roof, and the pile of soil is that thrown out after former leachings. The earth was obtained from the yard at the side of the hut, according to the method that is described as follows:

The raw material with which the manufacture of saltpeter is started is the soil from the yards and roads in the vicinity of the native dwellings. This is gathered by sweeping from the surface the loose soil particles and saline efflorescence that appears most conspicuously during the dry season. The ground is sometimes scratched to shallow depth with the large knives called *machetes*, and the soil thus loosened is included in the sweepings. Earth that has been leached and thrown aside becomes recharged with nitrate salts and can be reworked in the same way as the first gatherings, that is, by sweeping up the loose surface layers. Material can be preserved from the leaching of the rainy season under cover of a tight roof, and so may be worked at any season. That from the earth floors inside the huts, especially about the fireplaces, is used in this way.

Wood Ashes Used in Leaching

A charge of sweepings, gathered as described above, is poured out on the floor of the small inclosure where most of the work is carried on. The first step in the procedure is the addition of wood ashes. These are mixed dry in a proportion of about two measures of earth to one of wood ashes. The charge is then packed

FIG. 2. NATIVE SALTPETER MAKERS AT SAN AUGUSTIN

into the leaching pots. These are large earthenware pans, about 2 ft. in diameter and 8 in. deep. They are of ordinary red burned clay, unglazed, and are of local manufacture, being the same as the larger pots used for household cooking. The leaching pots are perforated in the bottom with a half dozen or more round holes, so that the liquor may drain out. Before the soil is put into the pots, these holes are covered with a piece of palm matting that acts as a coarse filter to prevent the soil from washing through. The ching pots are arranged on a low pole bench directly over similar pots with solid bottoms, placed to catch the solution as it drips through.

Fig. 2 is a nearer view of the same saltpeter works shown in the first photograph, including some of the native saltpeter makers, who are showing the visitors where the saltpeter has again become rich in earth that has previously been worked. Some of the earthenware pots used in saltpeter making may be seen at the left, and the bundles of twigs used to sweep the earth stand at the corner of the hut. The gourd cups held by the

women are the dippers used in transferring or dipping the solutions.

Crude System of Concentration Practiced by Evaporation of Solutions

The first step in the leaching process is to pour old liquor, saved from previous crystallizations, over the dry earth and ashes in the upper pot. The liquor is added gradually until it saturates the mixture and begins to drip through. After an hour or two, fresh water is added, and this gradually diminishes the density of the filtered solution. At this stage a fresh egg is placed in the solution that collects in the pan below, which serves as a sort of hydrometer, giving an indication from time to time of the relative density of the solution. At first the egg floats high, but it settles as the density of the liquor decreases with the addition of fresh water. When the egg hydrometer is almost submerged, no more fresh water is added, and after the drippings have practically stopped the liquor collected in the lower pot is withdrawn.

The liquor thus obtained is transferred to a pot capable of withstanding fire, and is concentrated by slow boiling. While boiling continues, several sprays of fresh green leaves are gathered in the yard near by and thrown into the solution. The leaves are said to assist in the formation of crystals. The plant used is called *mosote de citio*, although *piñon or cuanlote* are said to serve the same purpose. These are common native plants. When small crystals form on the back of the gourd used to stir and dip the solution, the desired stage in the evaporation is approaching, and final tests are made by dripping the hot solution from the gourd to the cold blade of a steel *machete* and observing the formation of the crystals. When it is found that these drops solidify quite rapidly with cooling, the cooking is stopped by drawing out the fire. The hot solution is filtered through cloth into a second pot, care being taken to save the drippings and rinsings, which are returned to the system. The liquor is then allowed to stand undisturbed over night, when it cools and deposits a crop of crystals.

First Stage of Process Results in Granular Mass of Impure Crystals

The crop obtained at this stage is a granular mass showing cubes of the chlorides of potassium and sodium and the elongated needle-like crystals of nitrate of potassium. This product contains a considerable amount of sulphates and other impurities, and is not ordinarily marketable. It must then be put through a second or refining process, which resembles in a general way the leaching operation just described.

The crystals derived from the first leachings are redissolved in the smallest amount of pure water that will take them up. For this operation pure water is sought, by preference rain water. The whites of several eggs are added to the pot filled with this solution, and the whole is placed over a fire and boiled. The coagulation of the egg albumen with cooking gathers the suspended impurities and, on settling, clarifies the solution. The boiling is continued until nitrate crystals form quickly in cooling test drops, when the solution is again set aside over night to deposit a crop of crystals. If successfully done, the step should yield pure nitrate of potassium in characteristic needle-shaped crystals, the best being perfectly white. The grade of the final product is usually judged from the color and the perfection of crystallization.

A byproduct frequently obtained from this process, and locally supposed to be common salt, is at times separated and sold for stock and even for table use, but its recovery is often neglected. Most of the salt thus recovered is yellowish and moist, suggesting impurities. Potassium salts are likely to be present in such a product, because of the wood ashes that are used in the process of recovery of the nitrate. The amount of this byproduct salt obtained, however, is so small that it is of little practical consequence.

Residues, rinsings, old liquor, and skimmings are all poured on the floor of the small inclosure in which the leaching and boiling are done, and are therefore saved to be reworked with later charges. The earth from which the salts have been extracted is thrown on the floor or piled over the edge of the walls surrounding the inclosure.

Small Production of Saltpeter

A small plant like the one represented in the illustrations is said to produce, when regularly worked, about 4 lb. of saltpeter a day, but operations are seldom conducted for more than five days in a week. A production at one of these plants of 100 lb. a month is reported. During the dry season from 20 to 25 women are engaged in the production of saltpeter about San Augustin, the estimated average production being about 20 lb. each a month. Most of the production is made during the dry season, from December to April, inclusive, probably at least five months in the year, although some saltpeter is made during other seasons. Thus the production from this town is perhaps not more than one ton of refined saltpeter a year, if it amounts to as large a quantity as this.

Samples of the earth from the yard about the saltpeter works described, from a small boring made in the yard, and from the materials used in various stages of the process, have yielded the analytical results shown in the accompanying table. The first was a thin scraping from the surface of soil in the open yard near one of the native huts in San Augustin. It being the rainy season, the soil was undoubtedly much leaner in soluble constituents than it would have been at other times.

ANALYSIS OF SAMPLE COLLECTED IN A YARD AT SAN AUGUSTIN
W. B. Hicks, Analyst

Field Sample No. 34 — Moisture in sample as delivered at the laboratory 5.30 per cent (obtained by drying at 100-105° C.)

ANALYSIS OF WATER-SOLUBLE PORTIONS EXPRESSED AS PER CENT. OF DRIED SAMPLE

Chemical Determinations		Calculated Salts	
K	1.49	KNO_3	2.43
NO_3	1.49	KCl	1.05
Cl	1.51	NaCl	1.66
CO_3	.14	Na_2CO_3	.25
Undetermined	2.09	Undetermined (a)	1.33
Total soluble salts (dried at 180° C)	6.72	Sum	6.72

(a) Qualitative tests indicate that the undetermined portion consists largely of sodium sulphate, calcium sulphate, and organic matter.

Predominance of Potassium Over Sodium

The predominance of potassium over sodium found in Sample 34 would be unusual in a natural deposit of mineral salts, and is thought to be due either to the effect of organic matter that had decomposed in this soil, or it may be the result of long-continued accumulation of wood ashes both from domestic fires and the use of ashes in the extraction of the saltpeter.

An auger boring put down in this yard yielded three more samples, as shown herewith. Fig. 3 shows the manner in which these were taken.

ANALYSES OF SAMPLES COLLECTED BY AUGER BORING IN A YARD AT SAN AUGUSTIN
W. B. Hicks, Analyst

Field Sample No.	Depth	Moisture per cent. of sample as delivered at the laboratory (obtained by drying at 100-105° C.)
22	1 to 6 in.	2.52
23	6 in. to 1 ft.	4.55
24	1 ft. to 1 ft. 9 in.	3.84

ANALYSIS OF WATER-SOLUBLE PORTIONS EXPRESSED AS PER CENT. OF DRIED SAMPLE

Chemical Determinations	22	23	24	Calculated Salts	22	23	24
K	....	0.53	0.43	KNO_3	0.03	0.24	0.12
NO_3	0.02	0.15	0.07	KCl	....	0.65	0.25
Cl	0.23	0.31	0.12	K_2CO_3	....	0.18	0.44
CO_3	0.21	0.18	0.22	Na_2CO_3	....	0.18	0.05
Undetermined	0.96	0.57	0.35	Undetermined (*a*)	....	0.49	0.33
Total soluble salts (dried at 180°C.)	1.42	1.74	1.19	Sum	....	1.74	1.19

(*a*) Qualitative tests indicate that the undetermined portion consists largely of sodium sulphate, silica and organic matter.

These samples contain only small amounts of soluble salts, and little nitrates, and are not representative of the material generally used in the saltpeter works. The supply of earth obtained for that purpose usually consists of sweepings or thin scrapings taken only from the surface of the ground. Analyses of these samples, however, furnish evidence that nitrates exist to a depth of nearly two feet, and throw some light on the distribution of salts in the soil. Thus, in summary, the surface materials (Sample No. 34) contain 6.72% soluble salts; the first 6 in. below the surface, 1.42%. Whether the decrease in soluble salts continued with

FIG. 3. SAMPLING SOIL IN THE YARD AT SAN AUGUSTIN BY MEANS OF A HAND AUGER

depth is a matter of conjecture, as the boring was stopped by rock or a layer of hardpan which it was found impracticable to penetrate. Possibly the soluble portion of this soil is much lessened during the wet season because of percolating waters and the fact that surface efflorescences are repeatedly washed away. It seems likely, however, that the average salt content of this firmly compacted ground does not vary greatly from season to season, except at the immediate surface, and that the supply of soluble salts is continually being replenished as a result of decomposition of soil minerals and organic matter. During the dry season this store of soluble material is drawn to the surface in solution by capillarity, where, as a result of evaporation, it accumulates as a saline incrustation.

Sample 33 consists of thin scrapings from the surface of a pile of soil and ashes thrown out from former leachings from the saltpeter works as shown in Fig. 2. It is said to have regenerated nitrate or saltpeter and shows by analysis the following composition:

ANALYSIS OF SAMPLE COLLECTED FROM OLD SALTPETER WORKS, SAN AUGUSTINE
W. B. Hicks, Analyst

Field Sample No. 33 — Moisture in sample as delivered at the laboratory, 5.30 per cent. (obtained by drying at 100-105° C.)

Chemical Determinations		Calculated Salts	
K	1.57	KNO_3	1.86
NO_3	1.14	KCl	1.62
Cl	1.20	NaCl	.71
CO_3	.11	Na_2CO_3	.19
Undetermined	2.98	Undetermined	2.62
Total soluble salts (dried at 180° C.)	7.00	Sum	7.00

These results show that the material that has been formerly leached contains roughly the same amount of soluble salts and a little less nitrate than do the thin scrapings from the yard; and in some measure they con-

FIG. 4. COLLECTION OF SURFACE SOIL FROM A MOIST BROWN SPOT IN THE ROAD AT EL RANCHO

firm the statement that the leached earth gradually becomes recharged with nitrates and ready to be worked again. In addition to the constituents determined, the sample contains a considerable amount of sodium, calcium, sulphates, and organic matter, and so the undetermined portion probably consists largely of sodium sulphate, calcium sulphate, and organic matter. A sample of the mixture of earth sweepings and wood ashes, exactly as this was prepared for a charge in the leaching pot at the beginning of a saltpeter run, was also taken, and gave the following results:

ANALYSIS OF SAMPLE COLLECTED AT A SALTPETER WORKS, SAN AUGUSTIN
W. B. Hicks, Analyst

Field Sample No. 32 — Moisture in sample as delivered at the laboratory, 2.53 per cent. (obtained by drying at 100-105° C.)

ANALYSIS OF WATER-SOLUBLE PORTIONS EXPRESSED AS PER CENT. OF DRIED SAMPLE

Chemical Determinations		Calculated Salts	
K	2.14	KNO_3	1.57
NO_3	.84	KCl	2.29
Cl	1.09	K_2CO_3	.72
CO_3	.34	Na_2CO_3	.05
Undetermined (*a*)	2.06	Undetermined (*a*)	2.04
Total soluble salts (dried at 180° C.)	6.47	Sum	6.47

(*a*) Qualitative tests indicate that the undetermined portion consists largely of sulphates and organic matter

The results indicate that an unnecessarily large proportion of wood ashes was used in the charge, because

potassium is present in considerable excess over that necessary to combine with the nitrate radical. It is possible that the procedure followed in the present instance, and out of the regular season of operation, did not have exactly the same effect that it would have had on materials collected from a more abundant crop of salts from the soil during the dry season.

The salts that began to crystallize in the cooling liquor obtained by leaching this mixture were chiefly cubes, suggesting potassium chloride or sodium chloride. Further cooling doubtless would have brought down the crop of potassium-nitrate needles.

A representative sample brought from these saltpeter works during the regular season of manufacture shows the general composition of the ordinary refined product.

ANALYSES OF REFINED SALTPETER FROM GUATEMALA
Stillwell & Gladding, New York, Analysts

Sample Number	Description	Per Cent. of Sample as Delivered Moisture	Insoluble
1	"White" crystals	1.50	0.19
2	"Yellow" crystals	5.88	0.34

ANALYSIS OF WATER-SOLUBLE PORTION EXPRESSED AS PER CENT. OF DRIED SAMPLE

Chemical Determinations	1	2	Calculated Salts	1	2
K	38.67	38.33	KNO_3	99.11	90.66
NO_3	60.81	56.15	$NaNO_3$	0.05	0.77
Cl	0.25	3.68	KCl	0.53	7.74
SO_4	0.06	0.25	K_2SO_4	0.11	0.45
Undetermined	0.02	0.25	Sum	99.80	99.62
Total soluble (dried at 150° C.)	99.81	99.66			

These analyses have been recalculated from the original statement to conform with the tables given of other analyses.

The description of saltpeter making at San Augustin doubtless fairly represents the processes used at other places in Guatemala. The analytical data obtained at this place were not wholly satisfactory, owing to unfavorable weather conditions at the time the investigation was made. Some tests made at other localities serve to throw a little more light on the subject of the distribution and character of the salts in the soils about the native villages, and are briefly reviewed.

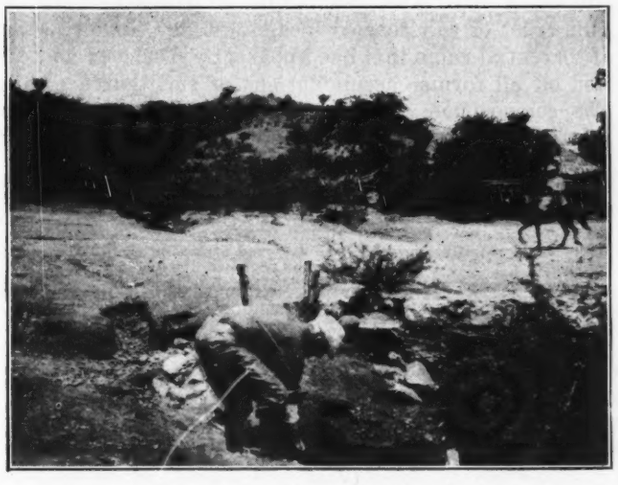


FIG. 5. THE COLLECTION OF SAMPLES 47 AND 48, FROM MOIST, DARK-BROWN EARTH FROM ROADSIDE IN EL RANCHO

Saltpeter is made in the town of El Rancho; and, in following an inquiry into the source and occurrence of the substance, various samples of nitrate-bearing earths were collected about this place. Field-nitrate tests made on the spot practically proved that the richest nitrate-bearing earth was confined to the moist, brown soil in the immediate neighborhood of houses, and thus the idea that the nitrate salts originate in the filth that accumulates about such places is more or less substantiated. These salts show more prominently in some towns than in others. Local variation of soil character may account for differences of this kind. In some places a loose, sandy soil and good drainage do not favor the retention of salts. In others, as at El Rancho, the soil

FIG. 6. VIEW SHOWING SITE AND COLLECTION OF SAMPLE NO. 42, AT MAGDALENA

in the streets is black and more or less gummy or sticky when wet, and the spots in the road that tend to remain always dark, moist, and slippery are reported to be richest in saltpeter. Sweepings from such spots as these are leached in the manufacture of saltpeter.

A shop at the upper end of the main street leading up from the depot in El Rancho carries a sign over the door, *Se venden polbora* (powder is sold here), and at this place samples of yellowish saltpeter, said to have been leached from sweepings from the road, were exhibited. The view showing the collection of samples 45 and 46 represents one of the moist, salty spots, this being in front of the shop mentioned.

ANALYSES OF SAMPLES COLLECTED IN THE ROAD AT EL RANCHO
W. B. Hicks, Analyst

Field Sample Number	Depth	Moisture per cent. of samples as delivered at the laboratory (obtained by drying at 100-105° C.)
45	Surface scraping	2.88
46	6 to 8 inches	2.76

ANALYSES OF WATER-SOLUBLE PORTIONS EXPRESSED AS PER CENT. OF DRIED SAMPLE

Chemical Determinations	45	46	Calculated Salts	45	46
K	0.12	....	KNO_3	0.31	....
NO_3	1.34	....	$NaNO_3$	1.58	....
Cl	0.15	0.05	NaCl	0.25	....
CO_3	0.05	0.10	Na_2CO_3	0.09	....
Undetermined (*a*)	1.39	0.43	Undetermined (*a*)	0.82	....
Total soluble salts (dried at 180° C)	3.05	0.58	Sum	3.05	....

(*a*) A considerable amount of calcium is present, and a portion of the nitrate is in all probability represented as calcium nitrate. The undetermined portion probably consists largely of calcium sulphate and organic matter.

The sample from beneath the surface contained so little saline matter that complete analysis has not been made. Only a small amount of surface efflorescence appeared on the soil between the frequent torrential rains, and the content of saltpeter in the sample is probably much lower than it would have been if taken during the dryer seasons.

Two other samples, Nos. 47 and 48, were collected near the locality where Nos. 45 and 46 were taken.

These came from the side of the road, where recent cutting of the water along a drainage channel had exposed moist, dark-brown earth. The surface soil was sampled separately (No. 47) in order to compare its salt or nitrate content with that of soil at a depth of 6 in. to 1 ft. below the surface, although both samples, being moist, showed no evident saline efflorescence. The two samples were apparently similar, except that the material on top was very dark, almost black, and that from underneath of slightly lighter shade.

ANALYSES OF SAMPLES FROM ROADSIDE IN EL RANCHO
W. B. Hicks, Analyst

Field Sample Number	Depth	Moisture per cent. of sample as delivered at laboratory (obtained by drying at 100-105° C.)
47	Surface	10.24
48	6 in. 1 ft.	2.00

ANALYSES OF WATER-SOLUBLE PORTIONS EXPRESSED AS PER CENT. OF DRIED SAMPLES

Chemical Determinations	47	48	Calculated Salts	47	48
K	0.13	....	KNO_3	0.34	....
NO_3	5.15	....	$NaNO_3$	6.78	....
Cl	0.66	0.03	NaCl	1.09	....
CO_3	0.10	0.11	Na_2CO_3	0.18	....
Undetermined (*a*)	2.61	0.30	Undetermined (*a*)	0.25	....
Total soluble salts (dried at 180° C.)	8.65	0.44	Sum	8.64	....

(*a*) A considerable amount of calcium and magnesium are present and in all probability a portion of the nitrate is represented by calcium and magnesium nitrates. The undertermined portion probably consists largely of calcium sulphate and organic matter.

Sample 47 is notable in that it shows about 7% of readily soluble sodium, calcium, and magnesium nitrates, with only a small amount of potash, these salts constituting the greater part of the soluble constituents in the sample. The soil from a short distance below the surface at this place not only contained much less soluble salts than that from the surface, but showed only an insignificant amount of nitrate. These samples remained persistently moist, indicating the presence of deliquescent salts. As may be seen from the view given herewith, this place is situated well above the main settlement, and there is no apparent reason for an exceptional accumulation of filth. However, it is clear that such soil is heavily charged with organic refuse, and the warm, moist atmosphere had the pervading odor of filth so often characteristic of towns in the tropics. The samples from El Rancho differ from those obtained in the yard at San Augustin in carrying less potash.

Two samples were taken by boring in El Rancho at the upper side of the road in a moist, brown spot a little further from the settlement than the site from which Samples 47 and 48 were obtained. The soil here was of mealy consistence. A sample from the surface of the ground gave a good reaction for nitrate by the field test, whereas the field test made on a mixed sample of the soil in the lower part of the hole was so faint as to be essentially negative. When examined in the laboratory, these samples were found to contain so little nitrate or other soluble salts that analysis was not carried out completely. The determinations are as follows:

ANALYSES OF SAMPLES FROM BORING AT UPPER SIDE OF ROAD NEAR EL RANCHO
W. B. Hicks, Analyst

Field Sample Number	Depth	Moisture per cent. of sample as delivered at the laboratory (obtained by drying at 100-105° C.)
20	To 8 inches	4.70
21	From 8 in. to 3 ft.	3.30

ANALYSES OF WATER-SOLUBLE PORTIONS EXPRESSED AS PER CENT. OF DRIED SAMPLES

Chemical Determinations	20	21	Calculated Salts	20	21
NO_3	0.12	....	$NaNO_3$	0.16	....
Cl	0.08	0.05	NaCl	0.13	....
CO_3	0.05	0.04	Na_2CO_3	0.09	....
Undetermined (*a*)	0.80	0.66	Undetermined (*a*)	0.67	....
Total soluble salts (dried at 180° C.)	1.05	0.75	Sum	1.05	....

(*a*) Qualitative tests indicate that the undetermined portion consists largely of sodium sulphate with some calcium sulphate, and organic matter.

At a depth of 3 ft. a free seepage of water entered the bottom of the boring, thus furnishing an explanation for the moist spot on the surface.

Reference is frequently made by the natives to the occurrence of *salitre* in the town of Magdalena, which is on the north side of Motagua River, four or five miles east of El Rancho. No evidence of saltpeter manufacturing was seen at this place, but it was stated that earth gathered in Magdalena was carried to San Augustin, where the saltpeter was made. Magdalena stands on a terrace about 60 or 75 ft. above the level of the river at this place, and the river front is bordered by a bare bluff of sandy and clayey river deposits. The clayey layers in these bluffs effloresce with white salts when they are dry, and these efflorescences are locally called *salitre*. Such efflorescences are found at other places along the bluffs bordering Motagua River. They were tested for nitrate in many places, with negative results. The native use of the term *salitre* in Guatemala and in Mexico is not confined to the true saltpeter, but means also a saline efflorescence, not common salt, because salt is a designated *sal* where recognized as such. *Salitre* thus seems to include what is commonly referred to as alkali in our Western States.

Analysis of samples from these alkaline efflorescences showed them to be largely sodium carbonate and sulphate, with some chloride. A trace of nitrate was found in some of the samples at the surface, but none from freshly dug material from below the surface. Considerable effort was made to check these conclusions, as this occurrence seems to have been the source of much misconception about the distribution of the saltpeter-bearing earth in Guatemala.

Some of the soil gathered from the terrace surface near Magdalena was found to contain an appreciable amount of soluble potassium salts, in part as the ordinary carbonate and sulphate. Near some of the houses saline efflorescences similar to those in the river bluffs were tested and found to be rich in nitrates. Fig. 6 effectively illustrates the nature of these occurrences. This crust of salt formed in a single day, following one of torrential rains that had apparently dissolved and carried off all former accumulations of such surface salts. The composition of this sample is also of particular interest, the nitrates found in it showing, as they are believed to do, the influence of organic contamination.

ANALYSIS OF SURFACE EFFLORESCENCE FROM MAGDALENA
W. B. Hicks, Analyst

Field Sample No.	Moisture in sample as delivered at laboratory, 10.05 per cent. (obtained by drying at 100 to 105°)
42	

ANALYSIS OF WATER-SOLUBLE PORTION EXPRESSED AS PER CENT. OF DRIED RESIDUE

Chemical Determinations		Calculated Salts	
K	2.20	KNO_3	5.69
NO_3	4.03	$NaNO_3$	0.74
Cl	2.50	NaCl	4.13
CO_3	0.08	Na_2CO_3	0.14
Undetermined (*a*)	6.04	Undetermined (*a*)	4.15
Total soluble salts (dried at 180° C.)	14.85	Sum	14.85

(*a*) Qualitative tests indicate that the undetermined portion consists largely of sodium sulphate, calcium sulphate and organic matter.

This sample is as rich in nitrates as are the soils used in the saltpeter works. The large percentage of soluble salts found in the sample (14.85%) is due to the fact that only a surface concentration was collected.

The foregoing is an abstract from a more detailed report of an investigation of the occurrence and manufacture of saltpeter in the Motagua Valley in Guatemala. Various rumors and one or two supposedly competent statements were received claiming the existence of ex-

tensive deposits in the country, which, as they were only being worked in the crudest way, were supposed to be worthy of development on a much larger scale. Such reports have been received especially during the war, not only from Guatemala, but from other parts of the tropics. No doubt they will recur from time to time as long as the interest in a possible new source of nitrate salts continues. For this reason, as well as for the general interest that a subject of this sort may have, it has seemed worth while to record in this paper, somewhat in detail, the basis of such rumors and reports.

Kennecott Copper Corporation

The report of the operations of the Kennecott Copper Corporation for the fiscal year ended Dec. 31, 1918, shows that a total of 660,228 tons of ore was mined and treated at the Kennecott and Latouche plants. The treatment of this material resulted in the production of 124,315 tons of concentrate for shipment to the smeltery, containing 32,457 tons of copper.

The concentrating mill at Kennecott operated throughout the year, but not to full capacity, owing to a shortage of labor at the mines, and, further, to decreased tonnage in May and June, due to the wrecking of the rope tramways by snowslides in the latter part of April. A total of 218,819 tons of ore, averaging 7.82% copper, was treated, with a resultant production of 27,174 tons of concentrates, assaying 53% copper. The extraction was 84.19 per cent.

The ore milled at the Latouche plant totaled 395,524 tons, this being an increase of 141,719 tons over the previous year. The average assay was 2% copper, and the extraction for the year was 80.7%, concentrate production totaling 49,915 tons, containing 12.8% copper.

The most important developments of the year were the discovery of an orebody on the 600-ft. level of the Bonanza mine, and of an orebody on the 900-ft. level of the Jumbo mine, about 400 ft. to the northwest of the main fissure. Rebuilding of the Bonanza rope tramway so as to increase its capacity to 600 tons per day was started and nearly completed. The construction of a rope tramway about 5000 ft. long to connect the Glacier mine with the Jumbo tramway was started.

Dividends paid during the year amounted to $5,574,089, and an equal amount was expended in capital distribution.

Storm in Texas Oil Fields

HOUSTON, TEXAS, CORRESPONDENCE

Much damage has followed a torrential storm in this section of the state on the morning of May 24, especially in the oil fields. The storm broke about 50 miles northwest of Houston. At Goose Creek, it is reported, only 27 derricks and a few houses are left standing in the whole oil field. One man was killed here, and the estimated damage was about $1,000,000. The Humble Oil Co. was the heaviest loser, only 5 out of 80 derricks being left standing. A 55,000-bbl. tank under construction was destroyed and four bunk houses were wrecked. The total loss to the company is probably $100,000. The Gulf Production Co. lost 100 derricks altogether, a loss estimated to amount to $40,000 by C. L. Jones, assistant manager. Simms interests have 3 derricks left out of 72. Other companies also lost heavily. At Spindletop, 25 derricks were blown down, and at Sour Lake, 11. Lightning at Hull struck a 55,000-bbl. steel tank belonging to Magnoleum Petroleum Co., setting fire to the contents. The Texas Co. also had some smaller fires here. The number of injured in the various fields is not yet known.

Foreign Trade in Metals and Ores

Imports and exports of the more important metals and ores, as reported by the U. S. Department of Commerce, for April, 1919, and the figures for April, 1918, as finally revised, are as follows:

IMPORTS, APRIL, 1918 AND 1919

(In pounds, unless otherwise stated)

	April, 1918	April, 1919
Metal and ore:		
Antimony ore, contents	264,857	46,616
Antimony matte, regulus or metal	1,734,790	924,848
Copper:		
Ore, contents	7,611,711	4,998,467
Concentrates, contents	2,793,200	2,374,639
Matte, regulus, etc., contents	3,642,542	2,400,549
Imported from (in part):		
Canada	2,215,712	1,731,661
Mexico	6,064,997	4,076,048
Cuba	2,399,040	3,650,176
Chile	2,564,125	6,643
Peru	422,602	309,127
Venezuela	176,227	*Nil*
Unrefined, black, blister, etc	31,294,232	22,781,489
Refined, in bars, plates, etc	2,192,706	556,303
Old, etc., for remanufacture	76,008	175,604
Composition metal, copper chief value	8,427	2,323
Lead:		
Ore, contents	3,859,129	2,731,279
Bullion, contents	9,529,400	7,527,446
Imported from (in part):		
Canada	3,210,714	1,791,152
Mexico	10,114,520	7,171,553
Pigs, bars and old	1,663,021	*Nil*
Manganese ore, long tons	58,039	59,47
Imported from (in part):		
Cuba, long tons	17,615	557
Brazil, long tons	33,084	57,590
Br. India, long tons	4,950	*Nil*
Pyrites, long tons	37,697	25,294
Imported from (in part):		
Spain, long tons	34,255	22,074
Canada, long tons	3,442	1,675
Tin ore, long tons	222	534
Tin bars, blocks, pigs, etc	13,035,803	504,903
Imported from (in part):		
Straits Settlements	7,550,189	504,903
Dutch East Indies	1,265,005	*Nil*
United Kingdom	1,131,248	*Nil*
Australia	858,962	*Nil*
Hong Kong	1,418,504	*Nil*
Tungsten ore, long tons	616	314
Zinc:		
Ore, contents	4,907,025	951,896
Imported from:		
Canada	612,000	83,607
Mexico	4,295,025	868,289
Blocks, or pigs, and old	10,463	23,040

EXPORTS OF COPPER, LEAD, AND ZINC

(In pounds)

	April, 1918	April, 1919
Copper:		
Ore, contents	350,186	*Nil*
Concentrates, contents	168,100	*Nil*
Unrefined, black, blister, etc	1,509,016	*Nil*
Renned, in ingots, bars, etc	49,854,754	17,841,731
Exported to (in part):		
France	12,906,783	1,120,000
Italy	8,911,644	*Nil*
United Kingdom	26,744,174	10,531,958
Canada	1,199,517	1,323,314
Composition metal, copper chief value	13,058	90,125
Old and scrap	157,450	118,084
Pipes and tubes	286,345	574,149
Plates and sheets	1,162,607	1,299,224
Wire, except insulated	811,722	3,310,788
Lead:		
Pigs, bars, etc., produced from domestic ore	12,512,185	1,066,919
Pigs, bars, etc., produced from foreign ore	1,882,788	4,252,408
Exported to (in part):		
Denmark	*Nil*	12,355
Canada	2,529,632	1,021,787
United Kingdom	10,303,271	3,345,985
Argentina	168,000	*Nil*
Japan	672,379	*Nil*
Brazil	239,826	*Nil*
Spelter:		
Produced from domestic ore	12,175,585	33,325,002
Produced from foreign ore	3,427,139	2,681,976
Exported to (in part):		
France	7,083,495	9,242,750
Italy	193,668	5,216,118
United Kingdom	5,509,354	18,990,919
Canada	2,190,381	902,574
Mexico	396,320	10,225
In sheets, strips, etc	2,842,090	2,156,184
Zinc:		
Dross	1,621,909	257,760

Economies in a Mine Power Plant*

By J. A. CARRUTHERS†

Several improvements that it was found practicable to make in mine-power equipment already installed are detailed in the following article, and the suggestions contained therein may be applicable to other plants. Slight changes in grates and bridge walls resulted in higher furnace efficiency; old boiler tubes were rejuvenated, and a considerable saving was thus effected. The installation of dampers secured good fire control; exhaust steam was properly utilized for heating purposes, and other changes that resulted in improved conditions and increased efficiency were made.

THE power plant to be described consisted of 11 return-tubular boilers with a manufacturer's rating of 150 hp. each, and 104 hp. government rating. Considering the former rating and assuming that one boiler was to be closed down for washing, the total available energy was 1500 hp. The power house contained three air compressors and two generator engines, all of the compound-condensing type. The generator engines were operated alternately at 24-hour intervals. The total indicated horsepower of the four units under regular running conditions was from 1425 to 1475. In addition there were two service pumps and four jet condensers to operate. Besides the power plant were several engines used for fans, hoists, shops, coal crusher, car loaders, and like purposes, which totaled about 300 hp. This, added to the power-house load total, made an average of 1750 hp. The air compressor load would often increase 30 to 50% for days at a time, owing to the demand for air in the mines.

Several of the boilers leaked badly at the rear end of the tubes, and examination proved that they had been rolled to a finish. A hard scale inside the tubes extending about a foot from the head was one effect of the leakage. As these same boilers were badly scaled inside on the back head and a portion of the tubes, four of the worst ones were cut out and retubed.

Saving Made by Utilizing Old Boiler Tubes

With tubes at war prices, new ones were put in the first boiler only. The old tubes in the meantime were cleaned by means of the home-made contrivance shown in Fig. 1 and then welded up for use in the next boiler cut out. In replacing the tubes, the new ends were put at the back end of the boiler. New tubes at that time cost about $11 each, and there were 70 to each boiler. The cost of welding up the old ones averaged about $3.20 for each tube.

These boilers, in common with most others of the same type, had the grates set scarcely two feet below the boiler shells, and this produced poor furnace conditions for the coal used, and these conditions were made worse by the fact that the bridgewall had been built to conform to the curvature of the boiler shell, and at a distance of from 10 to 12 inches from it. The result was that the gases were deflected against the relatively cool boiler surface before they had much chance to burn.

As a remedy for this poor furnace design, the grates were lowered considerably, as shown in Fig. 2, and the bridge walls were rebuilt flat on the top at a distance of 16 in. from the shell. The combination of the added furnace volume, and the free passageway afforded the burning gases to the back combustion chamber, resulted in a higher furnace efficiency. The increase in temperature was proved by the shorter life of the firebrick; also, the decrease in the amount of coal fired was soon noticeable.

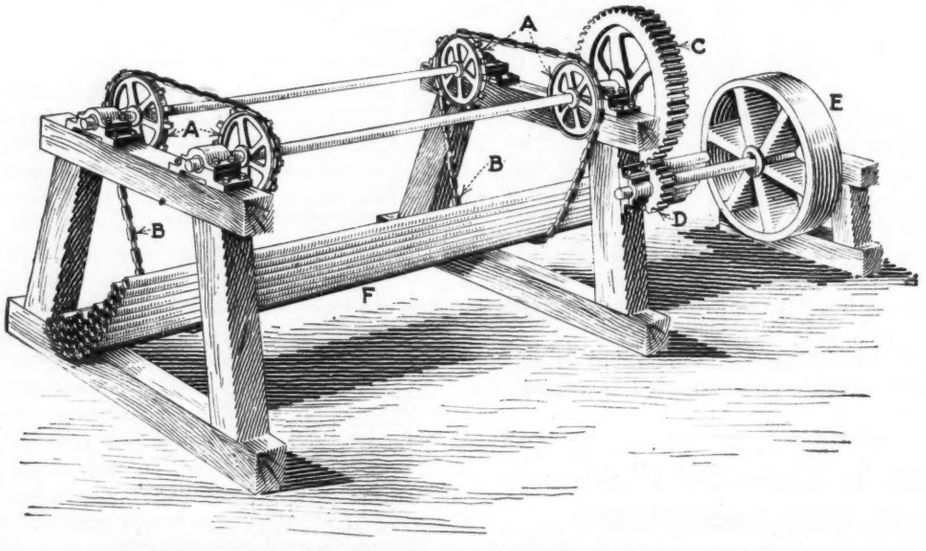


FIG. 1. RIG FOR REMOVING SCALE FROM BOILER TUBES

In lowering the grates, it was decided to replace the cast-iron fire-door arches and deadplates with firebrick. The cost of renewing these castings was between $70 and $80 every five or six months. This price refers to the cost of renewal of the castings per fire door.

The boilers had individual steel stacks, with no damp-

*Extracted from *Power*, May 13, 1919.

†Master mechanic Canadian Pacific Railway Mines, Lethbridge, Alberta, Canada.

ers fitted, so that the only draft regulation was by means of the ashpit doors. These were badly warped, and most of them would not close. Besides, this regulation was of no use when cleaning fires. As hand firing was practiced, at cleaning time the cold air rushed through the setting with full draft intensity, causing a considerable drop in temperature. To remedy this, as each boiler was cut out for washing a damper was fitted to the stack and the adjusting rope dropped within convenient reach of the firemen. After these were installed, the firemen were instructed to nearly close them when cleaning fires. The arrangement also gave some control over the fires if one of the large engines happened to shut down unexpectedly, and less coal went through the pop valves in the form of steam. The cost of making and installing the dampers was small.

Steam Header and Top of Boiler Properly Covered

Before the completion of changes in the boiler house a good quality of pipe covering, costing about $300, was put on the 16-in. steam header above the boilers in place of the original covering, which was of poor quality. The covering on top of the boilers was also overhauled and put in good condition by the use of some old plastic covering taken off an old, unused steam line. This class of covering will stand remixing and make a good job. The boiler settings were also gone over and all air holes and cracks in the brickwork were plugged.

One of the largest single losses around the plant was caused by the situation and design of the steam header serving the power-house engines and other equipment. This header included about 125 ft. of 16-in. outside diameter pipe, and 75 ft. of 12-in. pipe. There were also several 6-in. and 8-in. branch pipes leading to the various engines. All this piping was installed outside and directly under the drip from the roof. The large 16-in. flanges had never been covered, and the covering on the pipes was poor. Most of the flanges leaked at the threads, and the condensation, as shown by the leaks, was extremely high, as was to be expected in a place where the temperature is subject to big drops for days at a time. The header, as installed, required 60 to 70% more pipe than if it had been put up inside the power house.

Installation of New Header Facilitated Drainage

As it was impossible to make repairs to the header and at the same time keep the plant in operation, a new header was installed inside the power house. It was constructed of pipe on hand and a few of the fittings from the old installation. Instead of making the new header of 16-in. pipe, which was large enough for three or four power houses of the size served, pipes 12, 10, and 8 in. in diameter were used. This reduced size also facilitated drainage, owing to the increased velocity of the steam. Sufficient lagging to cover the new header was secured from some old unused boilers. This lagging came in slabs 6 x 36 in., but by splitting into 3-in. widths it made first-class pipe covering.

One of the two tandem-compound generator engines was in bad condition owing to the fact that the low-pressure piston and cylinder had worn enough to cause the piston rod to drop about one-eighth of an inch. The engines were of the horizontal type. This condition was remedied by fitting the low-pressure piston with two bronze wearing rings and all four packing boxes with bronze neck bushings. New piston rings were also put on, as the old ones had been passing steam badly. The low-pressure cylinder should have been bored out, to make a first-class job, but at the time the work was being done it was impossible to risk stripping the engine. While the low-pressure piston was being machined for the rings, the engine was run on the high-pressure end only, and carried the load all right. After over two and a half years' operation, the piston rod on this engine had dropped again only 0.008 inch.

The other generator engine had a bent piston rod and badly worn piston rings. These were renewed and the piston was given a one-quarter turn to bring the wear on a new section of the wearing rings.

Between 15,000 and 16,000 ft. of 1-in. pipe had been built into heating coils in the washhouse. The condensation from these coils had been allowed to blow to waste through a hand-regulated valve. Of course the valve was always left open enough to insure draining the coils "in case it happened to get a little colder." To get the benefit of this condensation for feed water,

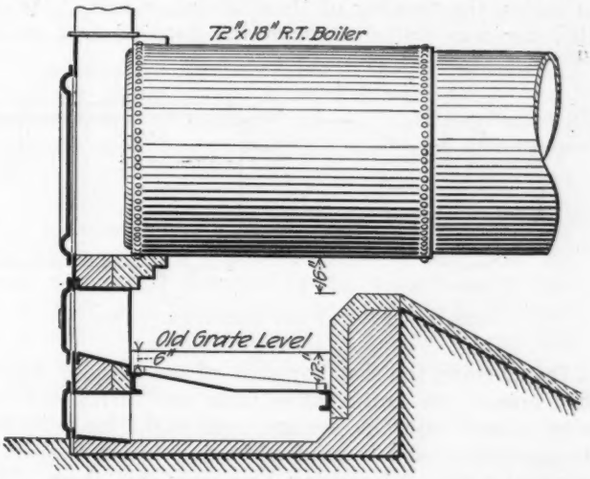


FIG. 2. BOILER SETTING SHOWING OLD AND NEW GRATE LEVEL

a good steam trap was connected to the outlet header of the coils. A bypass was also included, and in case the trap got out of order during the night, the watchman simply regulated the drainage in the same manner as before. The hot returns were discharged into a tank that fed by gravity into the open feed-water heater; some particulars of the connections to this tank are given subsequently.

The trap used discharged about two gallons per dump, and I have often counted the number of discharges at twice a minute on the coldest days, down to once every four or five minutes on the average days.

With about 600 men washing daily, a large amount of hot water was required, and a considerable amount was wasted. This water had always been heated by live steam in an overhead tank. To make matters worse, the tank was usually permitted to overflow "to make sure that there was plenty of water." To eliminate this waste, the live steam was shut off and the exhaust from one of the boiler feed-water pumps turned in. As one pump was always in operation, there was no chance of the exhaust being shut off for long.

In making the change of piping to this hot-water tank, the queer ideas of some men with regard to simple questions in engineering were forcibly brought home. Someone in former years had put a large steam coil of 2-in. pipe inside the tank, with the drain of the coil piped outside to a trap on the ground below. The trap

became frozen one night, and the coil broke at a return bend. After that the coil was allowed to drain into the tank through the break.

Utilization of Exhaust Steam for Heating

A cold machine shop is about the poorest place on earth in which to get any work done. The heating of the shops in this plant had been by means of stoves, but no one seemed to think that the heating really had been effective. To correct this condition, steam coils of old 2-in. pipe were put around the walls to a height of about three feet from the floor. A connection was then made for the exhaust steam from the shop engine to be used during working hours. When the engine was not running, by means of a reducing valve live steam at about 10-lb. pressure was utilized for heating purposes. To prevent any chance of the coils freezing, owing to drain valves being left closed, and also to eliminate any annoyance caused by adjusting the opening of these drains, a hole $\frac{3}{16}$ in. in diameter was drilled through the gate of each valve.

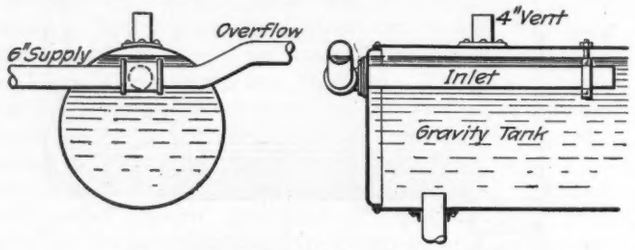


FIG. 3. PIPING TO GRAVITY TANK

In the morning the shop boy shut off the reduced steam, then opened the drain valves wide and turned the exhaust steam into the system. At night he reversed the procedure, and instead of having to set the drain valves to a required opening, he simply shut them. The small holes were sufficient to keep the coils drained with the pressure at 10 lb. Of course, there was a little steam wasted in this way, but simplicity and reliability were the most important factors to be considered.

Exhaust-steam heating was also put in two of the fan-engine rooms and locomotive sheds. As the fan engines ran 24 hours a day, practically every day in the year, conditions were ideal for exhaust heating. Before the heating coils were installed in the engine rooms, it was difficult to keep the oiling system in operation on cold days.

Change in Jacket-Water Piping Afforded Uniform Water Level to Feed-Water Heater

To provide a uniform head pressure to the water going to the feed-water heater, an overhead tank composed of an old boiler shell had been installed. This was good as far as it went, for every engineer knows how much better a heater float valve works with a uniform pressure than with a varying one. To supply the tank with water, the air-compressor jacket water had been piped to it, and entered at one end and overflowed at the other. As this system would waste the hot returns from the steam traps at the washhouse and the power house, the traps being piped to discharge into the tank, it was decided to change the jacket-water piping in such a way that the tank would not overflow and yet would keep a uniform water level.

It was first intended to use a float valve on a branch pipe from the jacket-water outlet header to supply the tank. However, after considering the natural troubles that accompany the use of most float valves, and trying one such valve, this method was discarded and the simple piping system shown in Fig. 3 was adopted. The solution was so extremely simple that it is surprising that it had not been thought of sooner. The idea may be of use to someone wishing to use all or a portion of the waste water.

Some of the outside steam pipes were leaking badly, and these were overhauled and thoroughly covered in preparation for below-zero weather. One old line about one-third of a mile long consisted of 8-, 6- and 4-in. pipes and apparently all the different fittings that could possibly be connected up. It was jogged up and down and sideways, and had several water pockets that furnished periodic slugs to the engines it served. Several hundred feet of the 4-in. size was laid on the ground alongside of the car track, and had been found very handy to thaw the snow shoveled from the track. This practice and rain had soon ruined the pipe covering.

The 4-in. section was relaid on trestles, properly covered, and given a 1% grade, and was also provided with a steam trap connected at the far end for proper drainage. The other part of the line, which had many fittings and jogs in it, was replaced by a new 6-in. line. Bends were used instead of the three or four slip expansion joints. These joints required frequent repacking, and the process had been the cause of several shut-downs of the fan engines. The water lying in the line seemed to make the life of the packing uncertain, and the result was either bad leaks or a shut-down at the first opportunity.

Quicksilver Ores*

Most quicksilver ores, according to F. L. Ransome, are of rather simple mineral composition. About 25 mercurial minerals are known, but most of these are rare and some of them contain quicksilver only as a minor constituent. Over 95% of the quicksilver produced in the United States comes from the bright cochineal-red sulphide of mercury, known in its natural form as the mineral cinnabar. Pure cinnabar contains 86.2% of quicksilver. Minor sources of quicksilver include metacinnabar, which has the same composition as cinnabar but is dark gray or black, and native quicksilver, which generally occurs in little globules but in some mines fills cavities of considerable size. The cinnabar in quicksilver ores is usually associated with pyrite or marcasite and less generally with the sulphide of antimony, stibnite. The commoner nonmetallic constituents of the ore are quartz, chalcedony, opal, calcite, mixed carbonates of calcium, magnesium, and iron, and barite. Many quicksilver ores contain also small quantities of an oily or asphaltic hydrocarbon, and some carry free sulphur.

No quicksilver ores that are mined on a large scale consist exclusively of pure cinnabar. The richest that are extensively worked are those at Almaden, Spain, where the average yield in 1917 was slightly less than 7%. Probably the lowest tenor in ores that are successfully mined is found on the Pacific Coast of the United States. The average yield of the California ores during the last two years was 0.38 per cent.

"Get what you can, and what you get hold," applies to W. S. S.

*An excerpt from *Bull.* 666-FF, U. S. Geological Survey.

Placer Operations in Cariboo Area of British Columbia*

By B. R. MAC KAY

HYDRAULIC mining operations are being conducted on Lowhee Creek, Stouts Gulch, and Mosquito Creek in the Cariboo area of British Columbia. The great handicap is scarcity of water. Owing to the altitude of this part of the area, which is over 4000 ft. above sea level, no large drainage basins exist, and the necessary water must be collected from small catchment basins. For this purpose John Hopp has an elaborate system of ditches over 32 miles long, tapping the small drainage basins where possible and fringing the mountains, collecting the run-off water. Even in the most favorable seasons, however, there is not sufficient water available to keep hydraulic mining operations in progress throughout the working season. A number of years ago Mr. Hopp had a plan under way to overcome this obstacle by installing a large pumping station at the north end of Jack of Clubs Lake, the plant to be run by electric power generated by falls on Swamp River. By means of this, water from the lake was to be pumped to the Lowhee ditch for use in the Lowhee mine, and to a reservoir on Island Mountain for use in the mining of the Mosquito Creek deposit. In the Lowhee ditch scheme the water would be practically in a circulating system, being pumped into the ditch and, after being used in the hydraulic operations, returning to the lake. In the Mosquito Creek system the water, after being used in the hydraulicking of the deposit, would drain into Willow River. As the lake has a depth of over 200 ft. in places, sufficient water was available for the undertaking. As with other projects under way, however, with the outbreak of the Great War this scheme had to be abandoned.

Lowhee Creek

Lowhee Creek flows northward into Willow River, joining it just east of Jack of Clubs Lake. The pre-glacial channel of this creek has been uncovered for a distance of 4000 ft., along which distance it is narrow, averaging about 300 ft. in width and characterized by interlocking spurs. The channel bed, having an average width of about 70 ft., is covered by pre-glacial gravels, boulder clay, and later gravels to a depth of 150 feet.

The transverse sections illustrated in the accompanying cut show the configuration of the pre-glacial valley and the approximate extension of the surface prior to hydraulic operations. Section 1 was taken at present workings, 4000 ft. above the lower end of the pit. Section 2 was taken near the company cook-house, 2000 feet above the lower end of the pit. The latter section shows, besides the deep channel, a still older channel about 30 ft. in width and lying about 60 ft. above it. Remnants of this older channel occur as rock benches at several places along the valley.

Although the pay streaks were found principally in the gravels lying near or on bedrock of the deep channel and the bench, considerable gold was evidently disseminated throughout the gravels, as old workings show the deposit to have been worked in a series of three or more levels.

*Abstracted from Summary Report, 1918, Part B, issued by the Canadian Department of Mines.

Hydraulic mining of this deposit has been carried on by Mr. Hopp for a number of years, and he has installed one of the most up-to-date plants in operation in the province. Water gathered from Lightning Creek, Jack of Clubs Creek, and several smaller streams is conveyed to the workings by means of 14 miles of ditches, Ella Lake, a depression lying in a tributary valley to that of Jack of Clubs Creek, four miles south of Jack of Clubs Lake, being used as the main storage reservoir. From a penstock on the west side of the channel a 250-ft. head of water is supplied to two monitors having 8-in. and 9-in. nozzles. The main sluice flume, 4 x 6 ft. cross-section, is 3750 ft. long, with a gradient of 4.35%. Throughout its length it is paved with wooden blocks 10 in. in height and 10 in. to 15 in. in diameter, the transverse rows being separated by strips of timber 1 in. in thickness. Along the upper part of the course the main flume is accompanied by a smaller flume 3 x 3 ft. cross-section, into which the water may be diverted and the gravels washed while the clean-up and repaving in the main flume are taking place. Better dumping facilities could not be desired. From the lower end of the sluice boxes to the level of Jack of Clubs Lake, about one mile distant, there is a drop of about 500 ft. in elevation, and the dumpage room is easily sufficient to take care of all the material of the deposit.

Large Boulders Encountered Necessitate Blasting

The great handicaps in the hydraulic mining of this deposit are the excessive length of flume, with its consequent heavy cost of upkeep in paving; the large boulders in the deposit, which require blasting before they can be run through the sluice boxes, and, as already mentioned, the scarcity of water. This latter difficulty has been somewhat overcome by diverting the water caught in the Ground Hog Lake reservoir and the Cariboo gold field ditch, which water is generally used in the hydraulic operations of Stouts Gulch deposits, into the Lowhee drain; but even with this extra supply there is not sufficient water available to keep mining operations continuously in progress throughout the working season.

Over 4000 ft. of the buried channel still remains to be mined, the greater part of which is virgin ground. As the hydraulic operations up to the present in ground previously drifted by the early miners have paid handsomely, and as the gravels exploited at the summit between Lowhee Creek and Stouts Gulch contained high mineral values, rich returns from the intervening unworked section are probable.

Stouts Gulch

Stouts Gulch is a southward trending tributary valley of Williams Creek Valley, entering the latter a short distance above the town of Barkerville. Unlike Lowhee Gulch, the pre-glacial channel is shallow and much wider, being over 700 ft. in width. The great width of this channel with respect to the length of the gulch, which is a little more than a mile, is exceptional and indicates that the channel is part of some larger drainage system. The channel has been hydraulicked out for

the greater part of its length, though untouched parts still remain along the sides. Section 3, taken at the workings about 2600 ft. from the mouth of the stream, shows the deep channel to be about 200 ft. in width and to have been covered by 85 ft. of overburden, of which the lower 30 ft. was gravel and the upper 55 ft. was boulder clay, and, later, gravels. Remnants of a bench about 300 ft. in width, lying 20 to 30 ft. above the deep channel, occur for a distance on the south side of the channel.

Gold Found Principally in Gravels

As in the other deposits, the bulk of the gold was found in the gravels, both in the deep channel and on the bench, concentrated on bedrock, and in the crevices of the schist, which has weathered to a distance of several feet below the surface. Some gold was found, however, concentrated on a false bedding of boulder clay, evidently deposited there by later wash from a tributary valley on the south side.

At the upper end of the pit the bedrock surface slopes off toward Lowhee Creek, indicating that the divide between these two pre-glacial channels has been crossed. It is worthy of note that considerable amounts of gold were recovered from bedrock up over this summit, and down the other slope. The total gold yield from this gulch is estimated at $2,500,000.

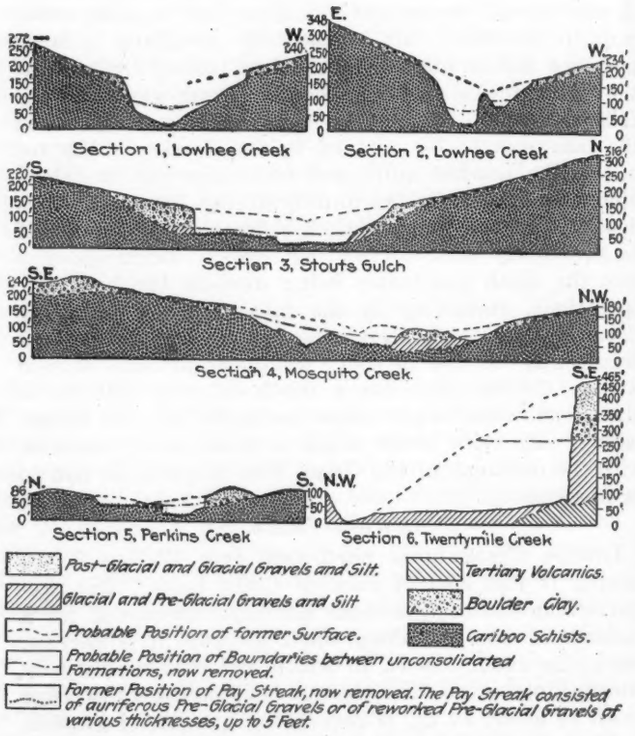
The water used in the hydraulic operations of this deposit is collected from the headwaters of Lightning and Jack of Clubs creeks and from the slopes of the mountains in the neighborhood of the deposit. Twelve miles of ditches are used for collecting and conveying the water to the workings. Ground Hog Lake, a cirque lake at the north base of Mount Agnes, has been converted into an excellent reservoir by the construction of a dam across its outlet. As this reservoir, and the ditch conveying the water to Stouts Gluch deposit, lie several hundred feet above Lowhee ditch, the former crossing Jack of Clubs Creek about 200 ft. higher in elevation than the latter, the water collected in the reservoir and the upper part of the ditch can be carried through the waste gate in the ditch, down Jack of Clubs Creek and into the Lowhee ditch. As already mentioned, during the dry season, when there is insufficient water to work both these deposits, hydraulic work on Stouts Gluch is discontinued and all the water available is used in the Lowhee operations.

Mosquito Creek

Mosquito Creek, which is a little more than a mile in length, rises on the slope of Island Mountain and flows northeastwardly into Willow River. The stream occupies a wide, shallow valley, and throughout the greater part of its course runs on glacial drift. In the lower part of the stream course, where the pre-glacial channel has been exposed for a considerable distance by hydraulic operations, the overburden, consisting of gravel and boulder clay, was found to be from 40 to 100 ft. in thickness. The width of the channel here was about 800 ft. At the present workings (see Section 4) the main pre-glacial channel is joined by two tributary channels. No indication of the position of the main channel or the presence of these tributary channels was supplied by the post-glacial topography, the deposition of outwash gravels and boulder clay being so great as to obliterate entirely the pre-glacial drainage courses.

The gold, which has been largely obtained from the buried channels, occurs in rich patches. The deposits were first mined by drifting, but sufficient gold was left to enable the gravels to be reworked by the hydraulic method. Although the main pay streaks were found in the gravels along the troughs of the buried channels, rich material was obtained from a bench running for a distance of 700 ft. along the east side of the valley and varying in height from 100 to 150 ft. above the bed of the deep channel. The gravel along the pay streak on the bench took the form of a low ridge, being much thicker directly over the pay streak than elsewhere. The presence of a pay streak in such an unprotected place in this wide valley points to the feebleness of glacial erosion in this part of the area.

The gold found is generally coarse and ragged. Many nuggets occur containing fragments of quartz still adhering to the gold; in some, the quartz forms over half the mass. Much crystallized gold is also found in the placer deposit, occurring as octahedron and rhombic dodecahedron forms.


Section 1, Lowhee Creek
Section 2, Lowhee Creek
Section 3, Stouts Gulch
Section 4, Mosquito Creek
Section 5, Perkins Creek
Section 6, Twentymile Creek
Post-Glacial and Glacial Gravels and Silt.
Glacial and Pre-Glacial Gravels and Silt
Probable Position of former Surface.
Probable Position of Boundaries between unconsolidated Formations, now removed.
Former Position of Pay Streak, now removed. The Pay Streak consisted of auriferous Pre-Glacial Gravels or of reworked Pre-Glacial Gravels of various thicknesses, up to 5 Feet.
Tertiary Volcanics.
Boulder Clay.
Cariboo Schists.

TRANSVERSE SECTIONS OF PRINCIPAL PLACER DEPOSITS OF THE CARIBOO DISTRICT, BRITISH COLUMBIA

The bedrock is highly folded and consists of schists and slates cut by numerous quartz veins from which the gold in the gravels was in all probability derived.

The water used in hydraulicking this deposit is collected from the northern slope of Island Mountain by means of five miles of ditches, and at best this supply is only sufficient to give a run for about two months. During the dry seasons hydraulic operations are carried on only a few hours a day or abandoned altogether. The exceptional richness of the deposit, however, makes up for the handicap in mining. Over $3,500,000 is said to have been already derived from this deposit.

Grouse Creek

Grouse Creek, a stream four miles long, flows northeasterly into Pleasant Valley Creek, entering the latter

near its junction with Antler Creek. For over thirty years the Waverley company worked the pre-glacial channel of this stream, having hydraulicked out a pit about 1200 ft. long, 200 ft. wide, and over 100 ft. deep. Recently a company represented by C. W. Moore and J. G. McLaren has taken over the property, and during last season had a number of men employed in Keystone drilling, erecting a sawmill, constructing reservoirs, and doing other preliminary work, with a view to beginning actual mining operations next summer. The intention is to work the untouched ground lying below and above the pit. At the head of the pit, where drilling operations were being conducted, the channel was about 100 ft. in width and lay about 90 ft. below the surface. The sluice flume used in the previous mining operations was found to be about 20 ft. above the bedrock of the main channel, and it is expected that the exploiting of these undisturbed gravels will yield rich returns.

Jack of Clubs and Slough Creeks

Jack of Clubs Creek rises from the northern slope of Mount Agnes and flows westerly and northerly, emptying into the western end of Jack of Clubs Lake. At present, John McDougall and F. Dewitt Reed are engaged in sinking a 110-ft.-shaft, from the bottom of which they plan driving a 120-ft. tunnel to tap the buried channel.

Slough Creek rises near the western end of Jack of Clubs Lake and flows northwesterly into Willow River. The creek occupies a valley almost half a mile wide, which undoubtedly was the pre-glacial drainage course of Williams and Jack of Clubs creeks. Mining operations carried on a number of years ago under the management of John Hopp showed the pre-glacial channel to lie 285 ft. below the present surface and to be in places almost 600 ft. in width. The valley is filled in with gravel and clay, the clay stratum, which lies about 50 ft. above bedrock, being in places 180 ft. thick. Owing to the excessive flow of underground water, the attempt then made at exploiting these deep deposits proved unsuccessful, but Mr. Hopp is satisfied that the water difficulty will be overcome. No attempt is being made to mine this deep ground at present, the work that is being carried on along the creek being confined to the hydraulicking of bench deposits along the southwestern side of the valley. The banks being worked are almost 100 ft. in height, and a generalized section of the deposit as exposed in the different workings is, in descending order, as follows:

Glacial and post-glacial outwash—beds of sand and gravel dipping northwest, about 40 ft. thick.

Boulder clay and gravel.

Coarse gravels, auriferous.

Slate bedrock intruded in places by tongues of igneous rock.

The gold is largely derived from the lower gravels.

Of the three plants in operation, the Point mine, owned by Loo Gee Wing, Vancouver, and run under the management of Joseph Wendell, is much the largest. An up-to-date hydraulic plant is installed for the working of a bench deposit. A face 500 ft. in extent is being washed by a series of monitors, the material being run through a series of four sluice boxes converging into a single tailrace. In this way the excessive supply of water obtained in the spring through the melting of the snow can be handled, and the work of washing a part of the bank can proceed while the clean-up from another part is being made.

Dragon Creek, a small northeastward-flowing tributary of Willow River, enters the latter about two miles below the junction with the Slough Creek. During the season Leo Muller and Otto Muller were engaged in tunneling along the buried channel of the creek and obtained favorable results. Recently Leo Muller bought out his partner's interest in the claim and is now carrying on the work single handed. Mustang Creek, a small creek less than two miles long, flows eastward into Sugar Creek. John Bell and William Thompson are engaged in preliminary work with a view to beginning actual mining operations as soon as possible.

Perkins Gulch

Perkins Gulch enters Lightning Creek on the north bank about one mile above Stanley. I. I. Felker and W. S. Sparkes, after several years spent in a systematic search along the lower part of this stream, have finally discovered a rich deposit a little over a half mile from its mouth. The deposit occurs in a pre-glacial channel, lying about 30 ft. above the present bed of Perkins Creek and entering it on the eastern side in a direction almost at right angles to the present course.

The buried channel is wide and flanked on the north side by a terrace over 100 ft. wide lying 30 ft. above it (Section 5.) The sections exposed in both the deep channel and on the bench are about the same, with the exception that no true boulder clay was to be seen on the latter, its place being taken by a thin bed of silt. The sections are as follows:

Character of Formation	Material	Bench	Deep Channel
		Feet	Feet
	Silt and clay.....	2	1775
Recent to Pleistocene depos.ts..	Fine gravel with sand lenses.....	6	
	Coarse gravel.....	8	
			Pay Streak
	Silt.....	2	..
Glacial boulder clay.....	.....	0	25
Glacial and pre-glacial gravels shingled up stream, auriferous.....	.....	6	6
		Pay Streak	Pay Streak
Decomposed bedrock.....	.....	1½	2
Fresh bedrock, Cariboo schists, strike north 45° west, dip 42° east.			

Pay streaks of both pre-glacial and post-glacial age occur. Coarse, rugged gold showing little evidence of wear occurs in the pre-glacial gravels, both on the rock bench and in the deep channel. In some places the gold was found to have worked down a distance of 2 ft. in the crevices of the decomposed schist. Another rich pay streak of finer, smoother gold is found in the coarse gravels immediately overlying the boulder clay of the deep channel. Whether this pay streak has been derived by the working over of the bench gravels which occupy the same horizon lying adjacent on the north, or whether it owes its orgin to the restoring of the deep channel deposits further up slope is not as yet fully determined, but the former opinion as to origin is favored.

Mining is being carried on by means of a small hydraulic plant, the necessary water for which is obtained from the drainage basin of Perkins Creek. With the small supply of water available, only a short season's run is possible. During much of the time the washing did not exceed a few hours a day, and this was made possible by collecting the drainage water in the reser-

voir during the remainder of the time. To overcome this difficulty Felker and Sparkes have procured water rights on Amador Creek and plan building a ditch to convey this water to the workings. As yet only a few hundred feet of the channel and bench have been cleared, but the returns from this have been phenomenally rich, over $5000 being recovered from a bedrock surface 100 by 150 ft. An attempt is being made to tap the old channel about 1100 ft. further up by a tunnel run through rock from the present channel of Perkins Creek, and in this way the time during which hydraulic washing cannot be carried on will be devoted to drift mining.

Chisholm Creek

Chisholm Creek, a small southward-flowing tributary of Lightning Creek, enters the latter at the town of Stanley. Although only a little gold was recovered from the present stream bed, the fact that the neighboring creeks have yielded in varying degrees led the Cariboo-Chisholm Creek Mining Co., under the management of J. A. McPherson, to undertake considerable prospecting in the lower part of the creek in search of an old channel.

By means of Keystone drilling, a buried channel lying about 400 ft. west of the present stream and about 30 ft. higher than its bed was discovered, covered by 180 ft. glacial débris and gravel. The gold contained in the gravels induced the company to drive a tunnel 1300 ft. long from near the present stream channel, a gradient of 5 in. per 100 ft. being given the tunnel for drainage. On completing the tunnel it was found to be about 10 ft. below the bed of the buried channel, and in order to tap this it was necessary to run upraises. The water pressure in the channel, which was found to be great, was relieved gradually by working alternately on the faces of a series of three drifts run from a tunnel paralleling the channel. After draining the channel, a considerable amount of exploiting of the gravel deposit was done, but the excessive width of the stream bed, which at this place exceeded 100 ft., prevented great concentration of mineralization. The channel at this point bears westward at an angle of about 30° with the present course of Chisholm Creek. Owing to the scarcity of labor brought about by the war, development work was discontinued, but will probably be resumed as soon as normal conditions are restored.

Cottonwood Canyon

Cottonwood Canyon lies on Fraser River about twelve miles above the town of Quesnel. At the foot of the canyon, about two miles above the mouth of Cottonwood River, banks of gravel and silt rise to several hundred feet above the level of the water. Over a distance of several hundred feet the lower parts of the banks on both sides of the river consist of streaks of clay, sand, "chicken-feed" gravel, and fragments of wood intimately mixed with numerous boulders of foreign origin, the whole deposit being firmly cemented by percolating solutions. Some of the boulders are large and many show polished and striated surfaces, the result of glacial action. The deposit lies on bedrock, which on the east side of the river is about 25 ft. above water level and on the west side a little below the level of the water. As far as known to me, no definite pay streaks occur, but the lower 6 ft. of the deposit contains sufficient gold to attract capital.

For a number of years the deposit on the east side of the river was worked in a small way by D. Killam, the cemented material being allowed to slack on the dump during the winter, and run through the sluice boxes the following summer. Recently an attempt has been made by the Tertiary Mining Co., of Chicago, under the management of D. D. Fraser, to work the deposit on a much larger scale. The cemented gravel is blasted, loaded into cars of 1 cu.yd. capacity, run to the mouth of the mine, hoisted over a trestle to the top of the mill, and dumped into a large hopper leading into a revolving trommel screen, where it is disintegrated. The screen, which is made of §-in. steel, is perforated with holes 1 in. in diameter and revolves at a rate of 17 r.p.m. The coarse material passes down the revolving barrel and into a chute leading to the dump; the fine material, passing through the screen, is fed into a sluice box fitted with Hungarian riffles, where the gold is caught. The area so far stoped out measures about 100 by 150 by 6 ft.

Government Creek

Government Creek, a stream about ten miles in length, flows southwesterly into Hixon Creek, a westerly flowing tributary of Frazer River entering about thirty-one miles north of Quesnel. For a number of years considerable prospecting has been carried on along the lower part of this creek by Dougal Cameron, and gravels estimated at about 4,000,000 cu.yd. are said to average 40c. per cu.yd. in gold and platinum.

Quesnel Mining Division

Although several dredges were operating on different parts of Quesnel River a few years ago, these attempts did not prove financially successful, owing to poor management, and since then no further effort has been made at mining the deposits. Recently, however, S. J. Marsh has procured a strip of dredging ground along the lower part of Marsh Creek, which flows northeastward into Quesnel River about twenty miles from its mouth, and along the main river for a distance of five miles downstream from the junction of this creek. Considerable prospecting by panning and sluicing has been carried on, and gold and platinum are said to have been obtained. Mr. Marsh is endeavoring to raise capital, with a view to installing a drag-line dredging plant to work the deposit.

Twenty-mile Creek, a small stream about seven miles in length, enters Quesnel River on the north side about twelve miles below Quesnel Forks. There the Quesnel Hydraulic Gold Mining and Development Co. is continuing operations under the management of K. C. Laylander.

The deposits being worked on Twentymile Creek consist of a 400-ft. bank on the east side of the stream about one mile above its mouth (Section 6). The upper 90-ft. stratum of this bank is of silt, sand, and gravel. This is underlaid by a 70-ft. bed of boulder clay composed mainly of small quartzite boulders firmly cemented in a brown, clayey matrix. Below this lies a 240-ft. bed of gravel of fluvioglacial origin. Volcanic bedrock, in places capped by a thin layer of yellow clay resulting from pre-glacial decomposition of the rock, is to be seen outcropping in the pit, but so far as observed there were no indications suggesting a confined channel.

The gold, which is mainly fine, is said to occur disseminated through the bank, the main proportion, however, being concentrated in the lower part of the deposit.

The plant of the Quesnel Hydraulic Gold Mining and Developing Co. is considered one of the most up-to-date hydraulic plants in the province of British Columbia.

The plant, including its nineteen miles of ditches, three large, inverted syphons, diverting dam on Swift River, and its many other unique features, is fully described in the annual report of the Minister of Mines, 1911.

An addition to the plant, however, has been made by Mr. Laylander in the installation of a mill for the saving of the black sand concentrate. An undercurrent placed in the lower part of the sluice boxes allows the concentrate to pass into a sump, from which it is raised by means of a hydraulic elevator, a distance of 20 ft. From this it passes over a grizzly, the gravels passing through the grizzly being fed into two Neill jigs, and the remaining coarser gravels passing off to the dump. The concentrate from the jigs is then passed over a 15-ft. by 4½-ft. Overstrom concentrating table, on which the sand is graded and the desired concentration obtained. In this way, about 1500 lb. of black sand concentrate is saved per day. As this concentrate is said to carry appreciable amounts of gold and platinum, this saving is a factor in the value of the deposit.

Keithley Creek

Keithley Creek, a stream ten miles long, heads on Cariboo Mountain and runs in a southeasterly direction into Cariboo Lake. Along most of its course it occupies a narrow, V-shaped valley, with banks of boulder clay and gravel rising steeply to a height of 200 to 300 ft. In places where the stream has cut through the drift and lowered its channel, either below the pre-glacial bed of the stream or into the rock shoulders which projected into the buried valley, the stream course is characterized by gorges and falls.

Remnants of at least two ancient channels buried beneath a blanket of glacial débris have been noted and traced for great distances along the present course. The drift covering was not sufficient, however, to fill the valley completely, and the stream in cutting out its present channel rarely lies more than 500 ft. distant from the buried channels.

Of these pre-glacial channels one occurs about 120 ft. above the stream, remnants of it being found on one side or the other of the valley. A later channel occurs near the level of the present stream bed, in some places being above the level of the stream and at other places below it. The gravels of this channel were found to be rich, and the stream where it has cut into or through them has been so enriched that certain parts have been worked six times.

At present the only mining carried on in this locality is a high channel deposit lying on the east side of the creek, 130 ft. above the present bed of the stream and one mile above its mouth. Here is situated the Kitchener mine, owned by R. W. Harrison and E. J. Worth. Harrison, assisted by three men, has driven a tunnel 100 ft. through the outer rim rock and has struck a very rich deposit of gravel. Two years ago Harrison and Worth worked another part of the same bench a short distance away, which yielded over $18,000 from 10,000 sq.ft. of bedrock surface; but the bench, averaging 40 ft. in width, on being traced, was found to have been cut away by later erosion, and a considerable sum was expended in determining its continuation.

The gold, which was largely coarse, was found to occur in two pay streaks—one, containing the coarser gold, occurred in gravel lying near bedrock, and in some places the gold was found wedged in the crevices of the quartzite schist to a depth of two feet; the other, a pay streak carrying somewhat finer gold, was found to be on a layer of silt occurring several feet above bedrock. Exceptional quantities were found beneath some of the large boulders lying on bedrock. Where pot holes occurred, gold was found around the rims and in small channels leading from them, but the pot holes themselves did not contain sufficient gold to make it worth while to clean them out.

There is little doubt that many other rich sections of these old channels still remain in this neighborhood undiscovered, so concealed by glacial drift that they were either overlooked altogether or the prospect tunnels run to locate them were too high or too low. If a road was constructed connecting this section with Barkerville or Quesnel Forks, so that a Keystone drill could be brought in, some of these likely areas could be prospected. At present prospecting has to be carried on by the slow, expensive, and unsatisfactory method of shaft sinking. Not only is it impossible to get in drilling machinery to carry on systematic prospecting, but, even where favorable indications are met, it is hard to interest capital in a deposit that is so difficult of access.

Harpers Camp

At Harpers Camp the International Dredging and Drainage Co., a Victoria syndicate, is operating on a flat of Horsefly River. The company holds three 250-ft. mining claims and one dredging lease extending for one mile along the river. Part of this ground was worked a number of years ago by R. T. Ward, and is said to have yielded rich returns.

The deposit consists of pre-glacial bench gravels lying on the northeast side of the present channel and buried beneath the covering of boulder clay and recent stream gravels. The gold ranges in size from flour gold to nuggets the size of birdshot. The fine gold occurs disseminated through the pre-glacial gravel bed, but the coarser gold was generally found concentrated either on bedrock or on a false bedding of clay lying about 14 ft. below the surface. Phenomenal quantities are said to have been derived from beneath a large boulder occurring on bedrock. Hydraulic elevators were used by Mr. Ward in mining these deposits, and four of these elevators may be seen almost completely buried in the old pits. The present company is operating a power scraper, which appears to be well suited to a deposit such as this, where the gravels to be worked are shallow, the floor is broad and with a gentle slope, and the bedrock is of soft shale.

The plant consists of a 45-hp. yarding donkey engine with 10 by 12-in. cylinders and a 3-drum hoist which operates a Stanley scraper of 2-yd. capacity. The scraper is 4 by 8 by 2 ft. and is bottomless, the base being supplied with eight 18-in. octagon teeth, 1¼ in. in diameter. The material excavated is held in place by the sides and back of the scraper. The scraper is said to work satisfactorily through a vertical distance of 100 ft. The gin poles, which guide the drag cables, are 30 ft. long and 16 in. in diameter and are generally placed about 600 ft. from the engine and about 300 ft. apart. Owing to the slight gradient of the stream, it was necessary to elevate the sluice boxes about 10 ft. to secure sufficient gradient for sluicing and dumpage room. The scraper is hauled up an incline and over a hopper feeding into the sluice box. The daily capacity of the plant is placed at 500 cu.yd. per eight-hour day. With a haul of 250 ft. or less, 1 cu.yd. per min. can be handled, the scraper making the forward haul in 1¼ min. and the return in three-quarters of a minute. A

DeVille gold-saving machine is used in connection with an undercurrent in the sluice boxes, to save the fine gold.

Owing to the large amount of tailing it was necessary to handle before getting into virgin ground, the returns so far have not been as satisfactory as had been anticipated. It is the intention in the near future to undertake systematic prospecting of this buried bench by Keystone drill, and it is reasonable to look for the discovery of rich deposits similar to the deposit already worked.

Black Creek

Black Creek is a southward-flowing tributary of Horsefly River, joining the latter about fourteen miles east of Harpers Camp. It is a small stream about four miles long. Throughout its course it occupies a V-shaped valley, and descends rapidly through a series of gravel stretches and rock gorges to the main valley of the Horsefly.

The present stream valley through the greater distance lies within the pre-glacial valley, which during Pleistocene time was almost completely filled by sand, gravel, and boulder clay. The pre-glacial valley was narrow and characterized by interlocking rock spurs, indications of which may be seen in the rock shoulders outcropping from beneath the blanket of drift. The stream in cutting its channel through the drift was in places superimposed on these valley spurs, and along these parts of the course it is characterized by deep narrow canyons. Two such canyons occur within 900 ft. of one another in the lower part of the valley. Indications met along the valley suggest that seldom, if anywhere, has the present stream valley been cut below the bed of the pre-glacial channel. Attempts made so far to reach the bottom of the buried channel have proved unsuccessful, owing to the presence of underground water.

Considerable prospecting has been done along the lower part of this creek, with favorable results, the coarse gold recovered being derived from the rock slopes of the buried channel.

During the season of 1918, the Western Mines Exploration Syndicate, of Vancouver, was engaged in drilling operations on the lower part of the valleys, with the object of tracing the channel and testing the gravels. It is expected that further testing will be carried on next year, and if the results warrant an attempt will be made to work this deposit.

Sufficient water collects in the drainage basin of the stream to make hydraulic operations possible on a small scale. Several good dam sites occur about 1½ miles further upstream, where rock shoulders have been found projecting into the valley from the east bank. An excellent site for a dump for the disposal of tailings occurs below the lower gorge. As the gold is generally to be found concentrated on bedrock, it will be necessary to do considerable quarrying to lower the bed of the gorge to that of the pre-glacial valley. The use of this artificial outlet will probably be more satisfactory than locating the mouth of the buried valley and following up the old channel to this point.

Conclusions

Practically every foot of promising placer ground in the Barkerville area is staked, though, owing to the adverse conditions, no work is at present being done on the majority of the claims. Some of these areas are lying idle because high operating costs have compelled the plants on them to close down, though work will probably be resumed when normal conditions are restored and sufficient capital can be acquired. Owing to the scarcity of water, other claims cannot be worked until the water now being used in hydraulicking of neighboring deposits is available. Still others are temporarily idle, because attempts to exploit the deposit have proved unsuccessful. Many others, however, are being held purely from a speculative standpoint, the holders making no effort whatever to work them, but depending on the development work done on neighboring claims to prove them as to their value, when they will seek to sell at a profit.

As in comparison with the other mining methods employed, the great proportion of the yearly output of this field is derived from hydraulic mining, and as practically all the water in the Barkerville area is already taken, and is being used, the possibility of an increase in this phase of placer mining is slight and is confined largely to the less exploited areas in the vicinity of Cariboo Lake and Horsefly River. Although the former locality is at present practically deserted, an improvement in transportation facilities into the area would stimulate further prospecting along the creeks of this region, and there is reasonable ground to expect discoveries similar to that recently made on Keithly Creek, of other rich deposits that have been overlooked by early miners.

There is, however, a possibility of an increase of the mining of the deep ground along numerous creeks, including Williams Creek, Slough Creek, Big Valley Creek, Lightning Creek, Willow River, Jack of Clubs Creek, Snowshoe Creek, and many others. Considerable careful and systematic prospecting by Keystone drilling has already been undertaken along many of these creeks, and pay streaks have been shown to exist, but the excessive pressure of underground water has made the exploiting of the deposits by drift mining impossible as yet. However, with the improvement in pumping machinery, the operators familiar with the magnitude of the obstacle to be encountered are confident that they will finally master the situation. Much of the ground is suitable for dredging. So far, the main drawback to the employment of dredges is the distance the deposits are from railways and the consequent excessive cost in installing plants. With the completion of the Pacific Great Eastern Ry. to Quesnel, this obstacle will be greatly reduced, though not altogether removed.

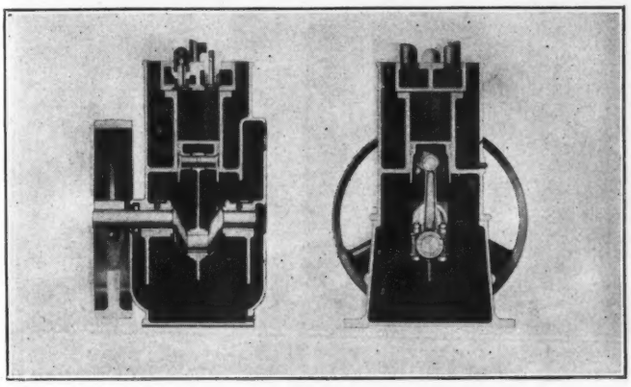
If cheap power were available, much of the now idle ground would in all likelihood be worked. The amount of power thus demanded for the running of dredges and of pumps employed in connection with drift mining, and for hydraulic purposes, in addition to that which would be consumed by the present working properties using fuel for power, would be so large as in all probability to warrant the installation of an electric plant. Indeed, this question has already been considered in connection with the two falls on Swamp River, one fall a few miles below the outlet of Isaac Lake having a drop of 75 ft., and the other, short distance below the outlet of Sandy Lake, having a drop of 70 ft., from which good routes are obtainable for a transmission line to Barkerville and neighboring areas. M. Bailey, who has thoroughly examined these undeveloped waterpowers, estimated that the minimum capacity would be about 50,000 hp. Owing, however, to the present adverse conditions, the scarcity of labor, the high cost of

supplies, and the distance from the railway, operators are reluctant to enter into any new project requiring a heavy outlay of capital.

Small Air Compressors

At the outbreak of the war a number of small air compressors were required for service where reliability was imperative. The Ingersoll-Rand Co. had just completed tests on the company's Imperial, Type 14 compressor, and had adopted it as the new standard small compressor, and its offer to produce these compressors for immediate use was accepted. The field performance of the machines has proved them to be efficient, reliable, and inexpensive to the operator, and they have now been placed on the general market.

There are four sizes, with capacities ranging from 3 to 45 cu.ft. per min. at pressures to 100 lb. per sq. in. The small compressors can, however, be used for pressure requirements up to 200 lb. per sq. in., the



SINGLE-ACTING AIR COMPRESSOR

horsepower needed being, of course, slightly increased. They are single-acting machines, of the vertical type, built for belt drive. If driven from a line shaft, tight and loose pulleys are supplied, and if the use of an independent motor is planned the machines are ordinarily furnished as a complete unit, with motor, endless belt, and short-drive attachment, and a hardwood base plate is included with the standard equipment.

The machines are well balanced, and operate satisfactorily if bolted to any solid flooring, but if permanency of installation is desired the building of a concrete foundation is advocated. The smallest size is built with a ribbed cylinder for air cooling where the service is intermittent and with water-cooled cylinder of the reservoir type for continuous operation. Larger machines are water cooled only, employing the reservoir jacket system, although, in the case of the largest size, a closed jacket for connection to the pressure system is optional. In this particular it is worth noting that the reservoir cylinder design affords unusually ample water capacity and that both cylinder barrel and head are cooled. It is stated that a single filling of the water space is sufficient for a 10-hour run.

In the general design, the Imperial, Type 14 compressor resembles an automobile engine. There is the same drop-forged crankshaft and connecting rod, the die-cast renewable bearings, the automatic splash lubrication system, and general ruggedness and simplicity which have come to be recognized as guarantees of satisfactory service under variable operating conditions.

Breaking Up Concrete

Concrete structures, either plain or reinforced, are usually considered to be of a permanent nature. It is, however, sometimes necessary to remove or destroy such structures, which are often situated inside of buildings and adjacent to valuable machinery; or the mass to be removed may be in close proximity to or inside of buildings.

The customary method of removing old concrete so situated is to drill holes with jumper steel and sledges by hand and then break off the material bit by bit by means of wedges. This is a slow and expensive process. The best, quickest and cheapest method to remove old concrete, brick or masonry is by blasting with explosives. Concrete is easily broken by blasting, and experience has shown that the better the concrete the more easily it can be broken.

It is essential in this class of work that the holes are properly placed—which, however, is true of all blasting—and that light charges of explosives are used. It requires no particular caution or ability to blast old walls of concrete, brick and like material when the structure is in an open place where there is little likelihood of damage to surrounding property. But in instances where the structures to be removed are situated close to and often are a part of valuable property, machinery and buildings, care and judgment must be instructions for the selection of the most suitable explosive and the depth of drill hole are given:

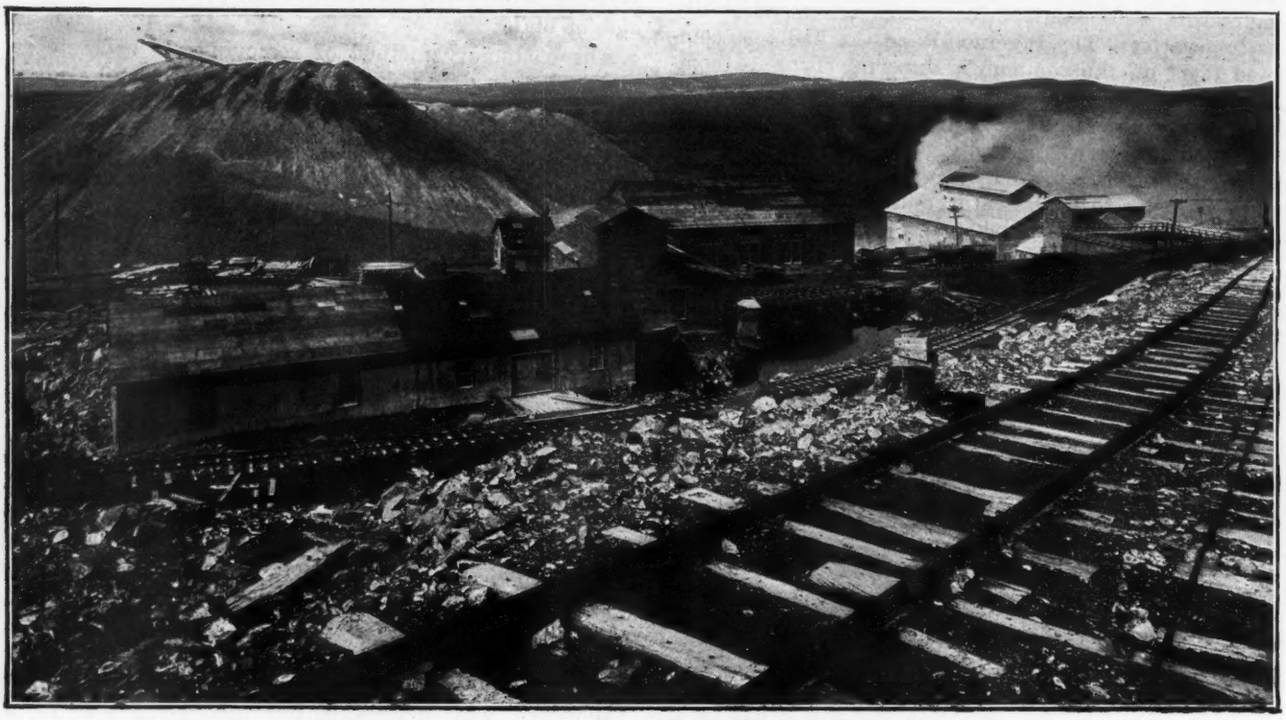
An explosive of relatively slow heaving action, like ammonia 30% to 40% strength, is best adapted for such operations, rather than a quick and shattering explosive. The drilling of holes is best accomplished by the use of self-rotating hammer drills, but when the size of the work does not warrant such equipment, holes can be drilled by hand, using jumper steel or hand drills and sledge. It is best to demolish the structure by gradual steps or benches, a little at a time, especially if situated inside or under a building. Holes are drilled, as a rule, from 1 to 1½ in. in diameter, and in depth depending on the thickness of the material, although 6-ft. holes are about as deep as should be shot in close quarters.

Franklin Mining Co.

During 1918 the Franklin Mining Co. hoisted 296,182 tons of rock, of which 273,964 tons was stamped and produced 2,827,313 lb. of refined copper. The following development was done: Drifting, 1618 ft.; raising, 121 ft.; sinking 253 ft.; and crosscutting, 157 ft. An electrically driven coal conveyor, operating between the stockpile and the bins at No. 1 boiler house, was built at the mine shops and put into service during the year, and an experimental regrinding plant, consisting of one 8-ft. by 48-in. Hardinge mill, one 75-hp. motor, and six Wilfley tables, was set up in the mill, but this was not placed in operation until 1919.

A total of 2,711,008 lb. of copper was sold at 24.239c. per lb. Other income, including copper on hand, totaled $88,830.33, and these amounts, less $51,270.42 (inventory, Dec. 31, 1917), totaled $697,671.84. Expenses for the year, including mining, smelting, freight, taxes, insurance and miscellaneous, were $806,795.

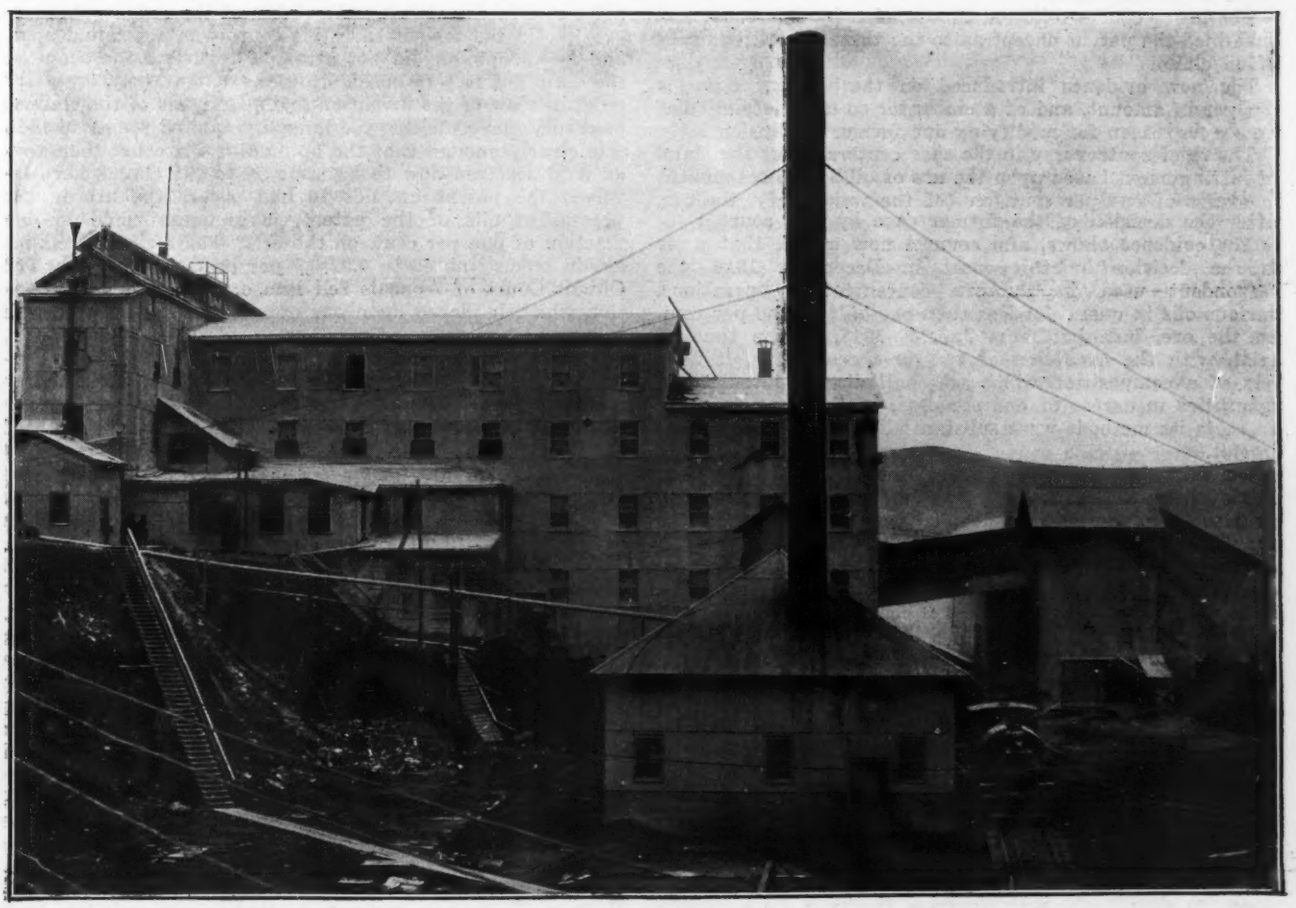
Asbestos Mills in Quebec



VIEW OF ASBESTOS MILL AND WASTE DUMP AT BLACK LAKE, QUEBEC

ASBESTOS DUMP AT BLACK LAKE, SHOWING DISPOSAL OF WASTE BY MEANS OF CONVEYOR BELT

OVERBURDEN AND WASTE DUMP AT THETFORD MINES. DISPOSAL BY CARS



MODERN ASBESTOS MILL AT THETFORD MINES, QUEBEC

The Flotation Decision

ON JUNE 2 the U. S. Supreme Court handed down its decision in the writ of certiorari proceedings instituted by Minerals Separation, Ltd., against the Butte & Superior Mining Co. The opinion of the court was delivered by Justice Clarke and is as follows:

This is a suit by the Minerals Separation, Limited, et al., plaintiffs below and petitioners in this court, against the Butte & Superior Mining Co., defendant below and respondent here, to recover for infringement of United States patent No. 835,120, applied for May 29, 1905, and issued Nov. 6, 1906, the validity of which was sustained by this court in *Minerals Separation, Limited, et al.*, vs. *Hyde*, 242 U. S. 261.

The patent has been so frequently described in court proceedings, that it will suffice to say of it here, in the terms of the specification, that it "relates to improvements in the concentration of ores, the object being to separate metalliferous material, graphite and the like, from gangue, by means of oils, fatty acids, or other substances, which have a preferential affinity for metalliferous matter over gangue."

The patent contains thirteen claims, which, for the purposes of this opinion, may be conveniently grouped, as follows:

(1) Numbers 1, 2, 3, 4 and 12, as "fraction of one per cent. claims," because they call for the use of that amount of oil on the ore; (2) Numbers 5, 6, 7, 8 and 13, as "oleic acid claims," because they are limited to the use of oleic acid in a small fraction of one per cent. on the ore—0.02-0.5 per cent.; (3) Numbers 9, 10 and 11, as "small quantity of oil claims," all three of which were held invalid by the former decision of this court. Only the five "fraction of one per cent. claims" are involved in this case.

The respondent denied the validity of the patent and the claim of infringement.

The lower courts followed the decision by this court and sustained the patent except as to the three "small quantity of oil claims."

The new evidence introduced on the validity issue is meager in amount, and of a character so unsatisfying that we see no reason for modifying our former conclusions.

The chief controversy in the case centers about the claim of infringement based upon the use of oil by the respondent in excess of one per cent. on (of the weight of), the ore, after the decision of the former case by this court.

The evidence shows, and counsel now admit, that prior to the decision by this court in December, 1916, the respondent used in its ore concentration operations, various oils in quantities less than one-half of one per cent. on the ore, but that from Jan. 9, 1917, to the time of trial, with the exception of two or three weeks, it used oils of a composition which we shall discuss later on, in quantities in excess of one per cent. on the ore. In other respects its methods were substantially those of the patent in suit.

On this showing, the District Court found the patent infringed by the respondent, when it used oil in quantities greater than, as well as when it used it in quantities less than, one per cent. on the ore.

The Circuit Court of Appeals held the patent infringed only when the respondent used oil in quantities equal to, or less than, one-half of one per cent. on the ore, and it therefore reversed both of the holdings of the District Court, but allowed recovery for the period when less than one-half of one per cent. of oil on the ore was used.

The Circuit Court of Appeals derived its authority to limit the claims to one-half of one per cent. on the ore from the construction which it placed upon the following clause of the opinion of this court in the former case, viz.:

"The patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of one per cent. on the ore.'"

The reasoning which carried two members of the court to their conclusion was that, as shown by the evidence of the patentees and the argument of their counsel, the amount of oil which is "critical," in the sense of marking the point of transition from the processes of the prior art to the process and discovery of the patent, is one-half of one per cent. of oil on the ore, and that therefore this court, by using the expression quoted, intended to limit the claims, not to a "fraction of one per cent." but to a "fraction of one-half of one per cent on the ore."

The specification of the patent points out that the proportion of mineral which floats in the form of froth varies with different ores and with different oily substances used and that simple preliminary tests are necessary to determine which oily substance will yield the best results with each ore. Of this feature of the patent this court said:

"Such variation of treatment must be within the scope of the claims, and the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject matter. . . . The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law."

Thus was it plainly held proper for the patentees to claim a reasonable degree of variation—"within the terms of the claims"—in the amount of oil to be used in the application of their discovery in practice, and that the restricting of the amount to a fraction of one per cent. on the ore was reasonable and lawful.

The two expressions "critical proportions" and "amounting to a fraction of one per cent. on the ore" being used, the former derived from the evidence and the latter from the claims of the patent, obviously, to the extent that they differ—if they differ at all—the language of the claims must rule in determining the rights of the patentees.

While in the former case this court was not called upon, and in its opinion did not attempt, to define the scope of the claims, but was considering the patent only from the point of view of the invention and usefulness of the claimed discovery, nevertheless, the language quoted seems to indicate clearly enough that the opinion of the court then was, as it is declared now to be, that as to the claims here involved the patent extends to and covers the use in the process of oils of the patent, in amounts equal to any fraction of one per cent. on the ore. The oleic acid claims are in terms limited to 0.02-0.5 per cent. on the ore. The Circuit Court of Appeals fell into error in the interpretation which it placed upon our opinion and its judgment in this respect is reversed.

Since the case must be retried there remains to be considered the reversal by the Circuit Court of Appeals of the holding by the District Court that the use of oil by the respondent in excess of one per cent. on the ore constituted an infringement of the patent.

As we have said, prior to the former decision by this court, the respondent used in its ore concentration process less than one-half of one per cent. of oil on the ore, and as to such practice infringement is clear, but from Jan. 9, 1917, to the time of the trial, with slight exceptions, it used in excess of one per cent. on the ore, and it is necessary to consider only the operations during this latter period. The oil used during this period was a compound, varying in composition from time to time, but we agree with the District Court in selecting as typical a mixture made up of 18 per cent. pine oil, and the remainder of petroleum products or derivatives—12 per cent. of kerosene oil, and 70 per cent. of fuel oil. Of this compound there was used 30 pounds to the ton of ore, which would be 1.5 per cent. on the ore. As thus stated, without more, it is obvious that the use of such an amount of oil would not infringe the claims of the patent which limit the oil to be used to a fraction of one per cent. on the ore.

But the contention of the petitioners, approved by the District Court, was, and now is, that kerosene and fuel oil were inert and valueless, if not harmful, as used by the

respondent in the process and rendered the recovery less than it would have been if the pine oil only had been used; that they were added solely to carry the content of oil beyond the prescribed fraction of one per cent. on the ore, in the hope of technically avoiding infringement; and that essentially in its operations the respondent used the process of the patent with .27 of one per cent. of pine oil on the ore, and therefore infringed it.

The respondent replied that it was not true that kerosene and fuel oil were inert and useless, and asserted that they were oils of the patent, "having a preferential affinity for metalliferous matter"; that the patentees by the claims of their patent had limited their exclusive right to the use, in the process, of any oil or oily substance having such an affinity, but in an amount not greater than a fraction of one per cent. on the ore, and that, therefore, the process of the respondent, in which more than one per cent. of oil on the ore was used, did not infringe the patent.

The entire evidence in the Hyde case was introduced on the trial of this case, and whether the petroleum products or derivatives used by the respondent were oils within the scope of the patent must be determined from the record now before us.

It is admitted that petroleum products are "oils having a preferential affinity for metalliferous matter."

In each of the four claims of the "Complete Specification" of the British patent, filed by the same persons who were patentees of the patent in suit, on June 3, 1905, "petrol" is given as an equivalent of oleic acid in the process. This appears in the statement, repeated in each claim, that the ore and acidified water shall be mixed or agitated with "a small proportion of an oily substance such as oleic acid or petrol, amounting to a fraction of one per cent. on the ore." "Petrol" is the name used in England for gasoline.

The claims of the patent in suit which we are considering call for the use in the process of an "oily liquid," "an oily substance," and in the twelfth claim simply of an "oil." These expressions are said by Professor Chandler, an expert for the petitioners, much relied on in the Hyde case and in this, to include petroleum products.

Higgins, one of the experimenters who discovered the process in suit, and who is much relied upon by the petitioners as an expert witness in both cases, testified as follows in the Hyde case:

Q. Have you since found it possible to use other oils than oleic acid with the result of producing a froth?

A. Yes.

Q. What other oils?

A. I have obtained satisfactory results by the use of petrol and certain proportions of distillate of crude petroleum, such as "Cosmos oil," and he said "Cosmos oil" is a "petroleum distillate."

Chapman, an engineer and a witness for the petitioners in the Hyde case, testified that he had obtained good recoveries in the laboratory and in commercial practice, from the ore of the Braden mine, in Chile, using three pounds of Texas fuel oil to one pound of American wood tar oil per ton of ore. Texas fuel oil is petroleum.

Graninger, an engineer employed by one of the petitioners in installing its flotation plants, testified in this case that in a mine in British Columbia he used a mixture of oil, 75 per cent. of which was derived from petroleum.

There is much more of the same character from witnesses for the petitioners and the evidence of the respondent is strongly to the effect that petroleum products are useful and efficient and have been widely used in the process in laboratory and commercial practice.

Without quoting more from the record before us, we must conclude that when the patent in suit was obtained, and even until the testimony in the Hyde case was closed in 1912, petroleum products were recognized by the petitioners, and that they are still used, as oils, efficient, and useful in the process of the patent in suit. Much of this evidence is especially impressive because the papers from which it is derived were written and the witnesses testified before the question as to petroleum, now made in this case, was raised or discussed.

While we thus conclude that petroleum and petroleum products are oils useful in this process of the patent, it is also clear that they are not as highly efficient as pine oil and several other oils and combinations of oils, which, in the nomenclature of the record are called "frothing oils," and also that better results would probably have been obtained by the use of less than one per cent. on the ore, of pine oil alone, than were obtained by the respondent with that oil in combination with the larger amounts of petroleum products. And this presents the further question necessary to a decision of the case, viz.:

Does the use of a more efficient, in combination with a less efficient, oil of the patent, constitute infringement, where the former is used in an amount within the limits of the claims but the combined amount is in excess of such limit, and when the amount of the more efficient oil used would probably produce better results from the process than are produced with the combination of oils?

To answer this question requires a consideration of the state of the prior art as it was when the discovery of the patent was made, and of the scope of the claims which we are considering.

It is always difficult to recover the realities of a situation long past, such as we have here, but it is especially difficult when the importance of the discovery has led, as in this case, to extensive improvements in mechanical appliances for utilizing the invention and to large additions to the knowledge of the adaptability to the process of various oils, singly and in combination.

We held in the former case that the patentees came late into the field of ore concentration investigation and that their discovery rests upon a prior art so fully developed that it was "clear from the record that approach was being made slowly but more and more nearly to the result which was reached by the patentees of the process in suit in March, 1905," and that their final step was not a long one.

Such a patent, in such a field of investigation, must be construed strictly, but candidly and fairly, to give to the patentees the full benefit, but not more, of the disclosure of their discovery which is to become a part of the public stock of knowledge upon the expiration of the patent period, and which was the consideration for the grant to them of a patent monopoly,

With the state of the prior art in mind, we come to consider the nature and extent of the disclosures of the patent in suit, but only with respect to the kinds and quantities of oil which may be used in the process.

The specification recites that the invention of the patent relates to an "improvement" upon prior processes employed in ore concentration "by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue."

Next come the specific disclosures required by the patent law (R. S. 4888), which are intended to describe the advance which the patentees claimed to have made from the prior art Cattermole agglomeration of metalliferous matter into granules, which separate from the gangue, and sink to the bottom of the pulp under treatment, to the discovery of the patent in suit, with its metal bearing froth, rising to the surface of the pulp. Here is the essence of the discovery and it is announced in these terms:

"We have found that if the proportion of oily substance be considerably reduced, say to a fraction of one per cent. on the ore, granulation ceases to take place, and after vigorous agitation there is a tendency for a part of the oil-coated metalliferous matter to rise to the surface of the pulp in the form of a froth or scum."

This is followed by the description of three "factors" on which "this tendency is dependent," viz.: slight acidification, heat, and fine pulverization of the ore, and then the disclosure concludes with the statement that the proportion of mineral which floats in the form of froth varies with different ores and with different oily substances, and that a simple preliminary test is necessary to determine which oily substance yields the proportion of froth or scum desired.

The only additional statement contained in the specification, which is in the nature of a disclosure, is found in the description of the example of the application of the invention, in which it is stated that the "froth or scum" derives its power of flotation mainly from the inclusion of

air-bubbles introduced into the mass by agitation, such bubbles or air-films adhering only to the mineral particles which are coated with oleic acid.

There remain the claims of the patent, in which the Act of Congress requires that the patentee shall "particularly point out and distinctly claim" "the . . . improvement . . . which he claims as his invention or discovery." And of these this court has said in *Keystone Bridge Co.* vs. *Phoenix Iron Co.*, 95 U. S. 274, 278:

"But the courts have no right to enlarge a patent beyond the scope of its claim as allowed by the Patent Office. . . . As patents are procured *ex parte*, the public is not bound by them, but the patentees are. And the latter cannot show that their invention is broader than the terms of their claim; or, if broader, they must be held to have surrendered the surplus to the public."

And in *White* vs. *Dunbar*, 119 U. S. 47, 52:

"The claim is a statutory requirement, prescribed for the very purpose of making the patentee define precisely what his invention is; and it is unjust to the public, as well as an evasion of the law, to construe it in a manner different from the plain import of its terms."

And see *Motion Picture Patents Co.* vs. *Universal Film Co.*, 243 U. S. 502, 510.

Since we are concerned only with the five "fraction of one per cent. claims," and since the question we are discussing relates only to the use of petroleum products, we need consider them only with respect to the amount and character of the oil prescribed, and, as they are substantially identical, we quote the first as typical:

"The herein described process of concentrating ores which consists in mixing powdered ore with water, adding a small proportion of oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of one per cent. on the ore), agitating the mixture until the oil-coated mineral matter forms into a froth, and separating the froth from the remainder by flotation."

The first three claims declare that, so far as oil is concerned, the discovery resides or consists in "adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter, amounting to a fraction of one per cent. on the ore"; the fourth claim differs only in substituting the word "substance" for "liquid" in the first three; and the twelfth claim provides for carrying out the process with "oil in water containing a fraction of one per cent. of oil on the ore."

From this consideration of the terms of the patent as written, it is apparent that it makes no differentiation whatever, either in the claims or in the specification, among the oils having a preferential affinity for metalliferous matter, and that its disclosure, to which the petitioners must be limited, is, that when a fraction of one per cent. on the ore of any such oil is used in the manner prescribed, there will be produced a metal-bearing froth, the result of the process. No notice is given to the public, and it is nowhere "particularly pointed out" in the claims, that some oils or combination of oils, having a preferential affinity for metalliferous matter, are more useful than others in the process, or that some may be used successfully and some not, or that some are "frothing oils," a designation not appearing in the patent, and that some are not. That patentees discovered the described process for producing the result or effect, the metal-bearing froth, but they did not invent that result or froth,—their patent is on the process, it is not and cannot be on the result,—and the scope of their right is limited to the means they have devised and described as constituting the process. *Corning* vs. *Burden*, 15 How. 252, 268; *Le Roy* vs. *Tatham*, 14 How. 156, 175; *Fuller* vs. *Yentzer*, 94 U. S. 288; *Robinson on Patents*, Section 149.

The patent in suit was applied for in this country on May 29, 1905, within a few weeks after the discovery which it embodies was made, and whether, from haste or lack of investigation, from the necessity of meeting the exigencies imposed by the prior art or from a desire to make the claims as comprehensive as possible, this discussion of its terms makes it clear, that the only disclosure as to the kind and amount of oil which the patenteees made to the public as necessary to the practicing of their process is that it must be an oil or oily substance, or oily liquid having a "preferential affinity for metalliferous matter," and that it shall be limited in amount "to a fraction of one per cent. on the ore."

It is argued that the provision of the claims that the mixture prescribed, of oil, water and ore, shall be agitated until the oil-coated mineral matter forms into a froth, serves to differentiate the "frothing oils" from others having the required preferential affinity for metalliferous matter but which, when agitated in the mixtures, may not produce the characteristic froth, if any such there are, and that a proper construction of the patent limits it to such "frothing oils" and renders the use of them in a fraction of one per cent. on the ore an infringement when used with "non-frothing oils" having the required affinity in amounts sufficient to make the combination exceed the quantity limit of the patent.

To give such a construction to the patent would subordinate the clear description contained in it of what are oils of the process, to an implied and vague description and classification which would leave the whole subject again at large, to become a field for further experimentation, without definition in the patent of what oils or froths would satisfy it. So interpreted the patent could not reasonably be said to contain a disclosure of the discovered process in the "full, clear, concise and exact terms" required by law (R. S. 4888) and the claims might conceivably be said to fall short of "particularly pointing out and distinctly claiming" any discovery at all within the meaning of the act of Congress.

Thus when to our former conclusion that the respondent used an efficient oil of the patent, we add the further conclusion, derived from a study of its terms, that the patentees failed to differentiate among the oils described in the patent, we must conclude that it is impossible for the courts to distinguish among them, as more or less efficient in the process, without amending the claims of the patent, and this they are powerless to do.

We are confirmed in the conclusion thus arrived at by the evidence which the patentees in the Hyde case, petitioners in this, introduced to show that their discovered process could not be made operative when more than a fraction of one per cent. of oil on the ore was used, and that the use of a greater amount would not produce the typical froth which results from it,—this without differentiation among the oils described in the patent, save as to their varying adaptability to different ores.

Thus, Ballantyne, a metallurgist and the patent agent who prepared the patent specifications for the petitioners, when called by them as an expert witness, testifies to intimate relations with the patentees and with their investigations before and since the patented discovery was made and says:

"I have never seen the agitation-froth process successfully carried out by the use of an amount of oil equal to practically one per cent. by weight on the ore, and in my opinion .9999 per cent. of oil would not be a proper quantity (that is to say a suitable and economical quantity), as contemplated by the patent, and would not, therefore, be a suitable fraction of one per cent., as contemplated by the patent."

Liebman, an expert much relied upon by the petitioners, testified:

"Q. I understand from your answer . . . that you have never in your operations . . . obtained any floating mineral-bearing froth when using an amount of oil, or other selective agents, amounting to more than one per cent. of the weight on the ore. In order that there may be no misunderstanding, will you state whether I have understood you rightly?

"A. That is my recollection."

John Ballot, one of the patentees, testified that he had never seen a froth of the character produced by the patent in suit using a pulp containing more than one per cent. of oil.

There is much more of similar import in the record. This, however, will suffice, adding only the record of a remarkable incident which occurred in this court during the argument of the Hyde case by Mr. Kenyon for the petitioners:

"Mr. Justice McReynolds: I would like to ask you when in this process of reducing oil your invention came into existence?

"Mr. Kenyon: At about one-half of one per cent. of oil.
"Mr. Justice McReynolds: Before you got to the one-half of one per cent. did you have any invention?
"Mr. Kenyon: We were passing from the region of Cattermole, which was a distant——
"Mr. Justice McReynolds: I want to know when your invention came into existence?
"Mr. Kenyon: This invention was not reached, I should say, from those figures, until about .5, that is one-half of one per cent. of oil was reached.
"Mr. Justice McReynolds: At one per cent. you had no invention?
"Mr. Kenyon: No.
"Mr. Justice McReynolds: At one-half of one per cent. you did have invention?
"Mr. Kenyon: It began to come. Remote, but it began to come. At .3 of one per cent. the float vastly increased. At .1 of one per cent. the float again vastly increased.
"Mr. Justice McReynolds: When this float has more than one-half of one per cent. of oil it does not infringe?
"Mr. Kenyon: It does not infringe.
"Mr. Justice Pitney: What have you to say in answer to what Mr. Scott said the other day to the effect that 1.8 per cent., or perhaps more, of oil, would give the same result with increased agitation?
"Mr. Williams: Absolutely no.
"Mr. Kenyon: It would not."

While parties should not be held rigidly to statements made by their counsel in the stress of argument, even when replying to questions from members of the court, nevertheless these statements from leading counsel in charge of the Hyde case and of this case, are impressive and significant.

This and much more of like character in the record brings us unhesitatingly to the conclusion that the scope we have given to the patent, based upon an interpretation of the language of the claims, is justified also by the evidence in the case and that it is, in fact, that which the petitioners and their counsel, until very recently, placed upon it in full confidence, that the essence of the discovery lay to such an extent in the use of a small amount of oil, such as is described in the patent, that the result could not be obtained with more than a fraction of one per cent. on the ore.

It must be added that the evidence is far from satisfying that the results of the respondent's process was, in fact, that peculiarly superior quality of metal-bearing froth characteristic of the patented process when worked with a fraction of one per cent. on the ore. The evidence, otherwise doubtful on the point, is rendered especially so by the testimony introduced by the petitioners, and not contradicted, that a computation on the basis of the tonnage of ore treated by the respondent shows that if the process as practiced by it after Jan. 9, 1917, had been used through the year it would have involved a loss of over a million dollars in increased cost of oil and in diminished recoveries, as compared with what the results of operation would have been for the same time using the process of the patent as practiced by the petitioners. It is difficult to see how a process so wasteful and inefficient as that of the respondent is thus proved to be can be other than substantially different from that of the petitioners.

It is vaguely suggested in the testimony for the petitioners that there was some peculiarity in the composition of the ore of the respondent, or in the treatment of it, which resulted in the presence of "clayey gangue slimes" which absorbed an unusual quantity of oil and that this contributed to render it possible to produce the results of the patented process when more than the prescribed fraction of one per cent. of oil on the ore was used.

It is hard to see how this, if true, would be of value to the petitioners, but the evidence is quite too indefinite in character and meager in extent to be accepted as the basis for the judicial determination of such a claim.

The respondent contends that the disclaimer filed by the petitioners with respect to the three claims held invalid by the decision of this court in the former case, was so delayed and is so evasive in form that it is invalid and that, for this reason, the petitioners should not be permitted to further prosecute this suit, under the provisions of R. S. 4917, 4922.

The decision holding the three claims invalid was rendered on Dec. 11, 1916, and the disclaimer was recorded on the 28th day of March, 1917. Having regard to the fact that the owners of the patent in suit resided in a foreign country, and to the war-time conditions of communication then prevailing, the entry required by law was not "unreasonably neglected or delayed." While the wording of the disclaimer borders on finesse, we do not think it can be interpreted as giving any rights under the patent greater than may be legitimately obtained under the claims held valid, and we therefore deem it sufficient to meet the requirements of the statutes cited.

It results that the decree of the Circuit Court of Appeals that the respondent infringed the patent only when using one-half of one per cent. or less of oil on the ore must be reversed, but that its implied holding that the use made by respondent of petroleum products and pine oil in excess of one per cent. on the ore did not constitute infringement must be sustained. The cause is remanded to the District Court for further proceedings in conformity with this opinion.

Promotion of Friendly Relations With The New Nations of Europe

A Letter to Mine Managers and Superintendents

I am wondering whether we cannot enlist the assistance of many of our mine managers in informing the foreign-born Americans in their employ that Mr. Hoover, as Director-General of the American Relief Administration, has made it possible for individuals in this country to transmit funds to their relatives in Finland, Poland, Czecho-Slovakia, German-Austria, Jugo-Slavia (including Serbia), Rumania, and Turkey. In securing this exclusive privilege from the Federal Reserve Board, the Government has been chiefly interested in reëstablishing banking connections between the newly liberated countries and America. It is the first concrete move to put these people on their feet.

As I look upon the intervention of our Government in Europe, it can be divided into four distinct stages: First, armed intervention; second, suggestion of peace terms; third, supply of relief to the liberated countries; fourth, reëstablishing of commerce between the liberated nations and the outside world.

Each successive stage represents the natural advance beyond the preceding stage, and all constitute a logical sequence of overlapping steps. For instance, armed intervention against Germany, even if successful from a military point of view, would not of itself have attained our full purposes in entering the war. Having effected the isolation of Germany, we had to endeavor to secure a satisfactory arrangement as to geographical division of territory. With this in the way of accomplishment we could not abandon the new countries thus established without making some effort to supply them with food.

Having drawn upon our stocks of food in America and placed these supplies at the disposal of the liberated countries in order to meet their requirements until their own harvest became available, we shall not have fulfilled our full obligations unless we make some effort to reëstablish commerce. Commerce is fundamentally dependent upon definite financial relations between countries which hope to do business with each other.

The development of the fourth stage of American intervention, therefore, has its beginning in the scheme that has been worked out by Hoover by which the banks in America are offered immediate contact with the banks in the liberated countries through the medium of the American Relief Administration. Beginning on Apr. 22 this new arrangement afforded foreign-born Ameri-

cans the opportunity to forward individual money gifts or payment of money to firms, individuals, institutions, or relatives at home. It was expanded in May so that drafts could be purchased on home banks and travelers could leave America with the satisfaction of knowing that their dollars here had a definite value in the currency of their own home country.

It is obvious that it would have been impossible, in the early stages after the armistice, to set up any such banking relations without the intervention of the Government, and this was made possible by the relief work of the American Relief Administration in Europe. But this is merely a stepping stone to permanent commercial arrangements, and the foreigners in America are asked to support this exchange system now, as it represents the definite beginning of financial connections between this country and the liberated nations. Though it is chiefly represented at the present moment in the transactions of food, it will gradually be transformed into transactions covering other commodities and lead to definite trade relations. The law forbids sending money by any other medium, and no one of foreign birth can justify using any other means for sending money to his relatives, as the support given by him to the American Relief Administration in this work is indirect support of his own government as well as that of the United States in its effort to complete the fourth and final step of its intervention in Europe.

The following rates are in effect beginning June 1 until further notice:

Finland, 9.65 finmarks per dollar.
Poland, 14¼ Polish marks per dollar.
Germany, 12.65 marks per dollar.
Austria, 24 kronen per dollar.
Czecho-Slovakia, 15½ kronen per dollar.
Jugo-Slavia, 23 kronen per dollar.
Rumania, 9.35 lei per dollar.

EDGAR RICKARD,
Joint Director.

American Relief Administration, 42 Broadway, New York. June 5, 1919.

[In order to promote this commendable enterprise, the *Engineering and Mining Journal* has donated a page advertisement on this subject, which appears in this issue. This has been put in a form so that mining and metallurgical managers may cut it out and post it on their bulletin boards for the general information of their employees, and we urge them to do that. Also, we urge readers associated with companies employing foreigners to cut out the page from their copies of the paper and hand it to their managers, so that an ample supply of these notices may be available at each mine and works.—EDITOR.]

Relaxation of British Embargoes

The *Board of Trade Journal* of May 22, according to *Commerce Reports*, announces certain relaxations of the export restrictions, transferring the following articles to List C, which covers articles that may be exported freely to the United States and certain other countries: Copper and alloys of copper, copper ore, regulus, matte, concentrate, and precipitate, men's woolen gloves, iron pyrites, and barium sulphate. The following articles have also been placed in List C by reason of change of headings: Silver bullion, specie, and coin, other than British coin.

Canada Mining Corporation's Efforts To Secure New Properties

The annual report of the Mining Corporation of Canada, Ltd., states that efforts were continued in 1918 to secure a suitable property for exploitation, but, though many investigations were conducted, some of which disclosed distinct merit, only one prospect has been acquired.

Canada and United States—In these two countries, 160 proposals were considered by the corporation management, against 90 in 1917, and a large number of these were examined by the company's engineers. In the Cobalt district, four properties were examined, and extensive work was done on three of them. All were rejected, however, as no orebodies were proved. At North Cobalt a property is now being actively prospected, though nothing of value has as yet been found.

In the Casey district, the corporation, working under option, is developing the Nels Nelson and other claims, where, in 1914, a shaft was sunk on a vein to a depth of 40 ft., but has since lain idle. This shaft, known as No. 5, has been equipped with headframe, hoist, and pumps, and the necessary buildings. It is to be sunk to the Keewatin contact, which several diamond-drill holes have shown to lie, in this neighborhood, at an approximate depth of 350 ft. Crosscut will be driven from this shaft, both at the 220-ft. level and from a level near the contact, northeasterly and southerly, closely following the plan suggested in 1914, of which details were at that time issued to the shareholders of the Casey Cobalt Silver Mining Co. This shaft, at the close of 1918, had reached a depth of 280 feet.

Of the other prospects in northern Ontario, the Rickard property, on preliminary examination, showed rich gold ore near the surface, but after a campaign of drilling and underground work, occupying over six months, discouraging results forced its abandonment. Near Madoc, in eastern Ontario, a vein of fluorspar was examined and finally acquired. A separate company controlled by the corporation was formed for its exploitation. A plant has been installed and a power line built to the property by the Ontario Hydro-Electric Commission. Development work has reached a depth of 200 ft. and a body of ore of good quality has been partly exposed. Shipments of this ore have been made to several buyers under contract, and are expected to be resumed soon. Depending on the future market condition, and on the results of further development of the orebody, the venture seems promising.

In British Columbia, and at other places in western Canada, several properties, examined or considered, were all decided to be unsuitable for acquisition, and the options were relinquished.

During a visit to Alaska, to examine the Engineer gold mines, C. E. Watson and his assistant, Mr. Randolph, as well as one of the chief owners of the property, lost their lives under most distressing circumstances, in the sinking of the steamer "Princess Sophia." No report on the examination was received and no further action has, under the circumstances, been taken.

Russia—Since the delivery of practically the whole of Siberia from the hands of the Bolshevik element, and the establishment of comparative order under the new Omsk government, which is being supported and has received quasi-acknowledgment by the foreign powers,

communication by post and telegraph has been reëstablished with the corporation's gold mine at Chebakee, in the Yenesei district, and the caretaker reports the property and buildings are undamaged. Acting on the advice of the British representative, the taxes were paid to the competent mining authorities, through the Bank at Tomsk, in October, and acknowledgment was received.

Examinations of Coal Properties

An examination of one of the largest coal fields in the Far East was made in the autumn of 1917 by Ross B. Hoffman, on behalf of the corporation. Mr. Hoffman was assisted by R. Smith, and, on advice of these two engineers, an application for a concession of the coal field was made to the Kerensky government, through the British consulate, and strongly supported by the chief Russian government officials of the Primorsk Province. Unfortunately, the fall of the government and the resulting disorganization of the country interfered with immediate progress of the negotiation, but a representative of the corporation was sent to the coal field in the autumn of 1917 and remained there, engaged in sampling, during the winter of 1918. The results of analyses of these samples, which were a representative series, indicated that the coals were of the high class reported, and in many instances better than any other in the Far Eastern market. This appears to be particularly the case with the coking varieties, of which a scarcity exists in Japan and China.

Negotiations have been continuously carried on since the establishment of the Omsk government, which has now declared itself anxious to assist the successful development of the fields by the corporation. In addition to the application for the government areas, private negotiation with owners of other portions of the coal field has resulted in the agreement of these parties to coöperate, and the discussion of terms is now in progress. In order to take advantage of the high local prices now obtaining, these owners are preparing to ship coal during the coming season, but on a comparatively small scale, as the full development of the field depends on the establishment of proper shipping facilities. This region in the past has produced, by petty efforts of small individual owners, without proper mining facilities, an amount estimated to be upward of 1,000,000 tons. Mr. Polevoi, a well-known Russian coal geologist, who has spent many years in mapping the field for the Russian government, estimates a quantity of marketable coal in excess of 500,000,000 tons, above the 700-ft. level.

On account of the quality of the coals, their position at tidewater and the presence of excellent and cheap Chinese labor, it is believed that a large and good market is assured, but the question of the method of development and the study of the best means of arranging for shipping facilities will require careful investigation, for which considerable time is necessary. In the event of proceeding with the development of this field, a large amount of capital will be required for development and exploitation.

Favorably situated on the coast, not far from the coal field, a lead-zinc-silver mine, formerly in control of Germans, has been working, without proper mining equipment, for ten years or more. At the outbreak of the Great War, it had an annual output of about 60,000 tons, but, because of the absence of a smeltery, it was under the necessity of shipping the ore, at heavy cost, to Europe, and, after the outbreak of the war, to Japan. This property is also under negotiation by the Mining Corporation. It has been examined by several well-known mining engineers, and, in a preliminary way, by Mr. Hoffman on behalf of the corporation, who recommended further work being undertaken. The ore developed is variously estimated at from 200,000 tons to 350,000 tons, but it is believed that a much larger tonnage of good quality exists below. Further work by drilling or adits is necessary to prove this, and, to operate economically, the installation of an up-to-date mining and smelting plant will be required. Until recently, causes somewhat similar to those already described have interfered with negotiations, but discussion of terms has now been resumed. Continued negotiations for options on both the coal and the lead-zinc-silver properties is recommended.

In northern Siberia, also on the Eastern coast, an interesting alluvial property was the subject of prolonged negotiation during the last year, but litigation in the early winter interfered with the consummation of business. It is hoped that satisfactory terms may be arranged later, when the settlement of the suit between the owners is concluded.

Properties in China and Mexico

China—A number of proposals were investigated in this country, and a large and interesting enterprise is recommended for consideration. At the beginning of 1918, a favorable option agreement was concluded in northern Manchuria for a large alluvial gold property, which had been examined in a preliminary manner by Mr. Hoffman, and reported to be worthy of a thorough investigation. A party was sent to the property last winter, and carried on intensive work by drilling and other methods, until September, 1918, when it was finally decided to relinquish the option. The abandonment of this property was a great disappointment, as its large area, the almost perfect physical conditions for successful dredging, and its favorable situation regarding transport would have made it a most suitable field for development by the corporation had the gold content been a little higher. Situated in more favorable regions, like the Sacramento Valley, with cheap power and a better climate, it would doubtless have been profitable to operate, but under the existing conditions it was decided to give up the option.

Mexico—Several properties have been presented in this country, but at present conditions there are such as to make it inadvisable to risk investment, unless the corporation is prepared to lock up capital for an indefinite period.

General—A large sum has been expended on the search for properties in many parts of the world, and of the many hundreds examined and considered, presuming that adequate terms for options can be arranged, a number are recommended for further examination.

In these days of keen competition for investment in mines by strong groups, it is the rarest chance that a property is acquired merely on a preliminary examination, and the expenditure of considerable sums is generally necessary for the purpose of definitely proving that the risk is warranted. It is suggested that instead of indefinitely continuing search, a choice be made from those recommended properties, and one or more selected for a thorough examination.

Investigation of Petroleum in Mexico

Official notice has been received from the Italian Secretary of Industry, Commerce, and Labor, according to Charles H. Cunningham, Vice-Consul of Mexico City, in *Commerce Reports*, that within a short time an official commission will arrive in Mexico from Italy to study the petroleum laws of Mexico. It is understood that other countries will also send delegates, and among the latter is Russia, whose government recently communicated its intentions in that particular through its consul. The Russian government is obtaining all the data possible relative to the production of petroleum in Mexico, as well as the government policy of exploiting same, with the object of improving the methods used in that country, which is considered to be one of the most important petroleum-producing countries in the world today.

The various European commissions were expected about June 1, reports having reached Mexico City that some of the specialists comprising them are already on their way to Mexico. It is understood that they will first come to Mexico City for consultation with certain high officials of the government, after which they will visit Tampico and the other oil-producing sections of the republic.

It is also officially reported that two American prospectors have solicited permission from the government to make explorations in the northern part of the State of Chihuahua, where they believe there are large deposits of petroleum. They base their belief on the grounds that important oil deposits lie immediately across the river Bravo in the State of Texas, from which a considerable yield has been obtained. These deposits are in the same geological zone. Permission to explore the federal districts of Casas Grandes, Guzman, Trinidad, and Santa Maria has been requested by these prospectors. The government has their petition under consideration.

Coördination of National Employment

At a conference on employment called by the Secretary of Labor and held at Washington, Apr. 23, 24, and 25, the delegates, representing the governors of states and the U. S. Employment Service of the Department of Labor, unanimously adopted the following expression of principles and purpose in regard to a bill to provide for a national employment system:

In the outline it is provided that the U. S. Employment Service shall be continued as a permanent bureau in the Department of Labor, for the purpose of promoting the establishment and maintenance of public employment offices for men, women, and juniors. Provisions are to be made for the management and business administration of this service. The bureau is to establish and maintain a system of employment offices where such service is not already in existence and is to coördinate various other employment offices. Expenses are to be met by regular appropriations, which, after the deduction of the general maintenance office expense, are to be allotted to the various states on the basis of their population. In the event that certain states have already provided appropriations for the maintenance of public employment service bureaus, these amounts will be supplemented by an equivalent appropriation from the Government up to a sum allotted in accordance with that paid on a population basis.

Civil Service Positions Open

The U. S. Civil Service Commission announces open competitive examinations for the following positions: At the Naval Ordnance Plant, Charleston, West Va., superintendent of heat treatment, July 1, $5000 a year; production engineer, July 1, $9.28 a day; assistant designing engineer, July 8, $9.20 a day. There are also the following vacancies in the Ordnance Office, and in the Ordnance Department at Large, War Department: Catalytical chemist, $3000 to $4000 a year; assistant catalytical chemist, $2000 to $3000 a year; junior catalytical chemist, $1600 to $2000 a year.

Competitors will not be required to report for examination, but will be rated on various subjects covering principally education, experience, and fitness. These examinations are open to all male citizens of the United States who meet the requirements.

Applicants should at once apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C.; the Secretary of the U. S. Civil Service Board, Custom House, Boston, Mass.; New York, N. Y.; New Orleans, La.; Honolulu, Hawaii; Post Office, Philadelphia, Penn.; Atlanta, Ga.; Cincinnati, Ohio; Chicago, Ill.; St. Paul, Minn.; Seattle, Wash.; San Francisco, Calif.; Old Custom House, St. Louis, Mo.; Administration Building, Balboa Heights, Canal Zone; or to the Chairman of the Porto Rican Civil Service Commission, San Juan, Porto Rico.

Chemical Warfare Service Men Desire Reëmployment

For more than six months the Chemical Warfare Service has been endeavoring to find situations for its chemists as they were discharged from the service, provided they had no places of their own to which to go, according to a communication from Maj. Frederick M. Crossett, C.W.S. Most of the men are college graduates or had partly completed their college course at the time of entering the service, and many of them had engineering and mining experience. They are now seeking reëmployment in those lines.

Employers can reach these men by addressing the Director of Chemical Warfare Service, Washington, D. C. This situation presents an opportunity to employers to make a selection from picked men, graduates of the best technical schools, who have had the benefit of military training and experience.

May Pig-Iron Production

Pig-iron production during May was 2,108,056 gross tons, or an average of 68,002 tons a day, as compared with 82,607 tons daily in April, 99,685 tons a day in March, and 111,175 tons a day in May, 1918, according to *Iron Age*. This is the lowest daily average since March, 1915, when 66,575 tons was made per day. There were only 195 furnaces in blast June 1, 29 having been blown out during May and 12 blown in. Six stacks operating on ferro-alloys produced 14,604 gross tons, of which 11,157 tons was ferromanganese. On June 1 the estimated capacity of the 195 active furnaces was 68,100 gross tons, as compared with 212 furnaces in blast on May 1, with an estimated capacity of 75,860 gross tons.

Ore Dressing and Metallurgy

Operators who have used sand beds for the purpose of clarifying water notice that, under certain conditions, a gradual blackening of the filter medium occurs. In the following note it is suggested that this is due to manganese and iron.

The charging of precipitate into a tilting furnace designed so that the flame or heated air causes currents around the top of the crucible results in dusting losses and other disadvantages. An ingenious modification of normal practice is described, by means of which a saving of time and fuel is effected and the life of the crucible is lengthened. A further advantage that accrued in the instance in question was that it became practicable to allow two bars of bullion to accumulate in the furnace.

Graphite is a substance which responds to "skin-flotation" practice. In such cases no oil is necessary. A description of a typical method follows and a flow sheet is given which indicates the various operating phases in the treatment of graphite ore.

Blackening of Sand in Filters*

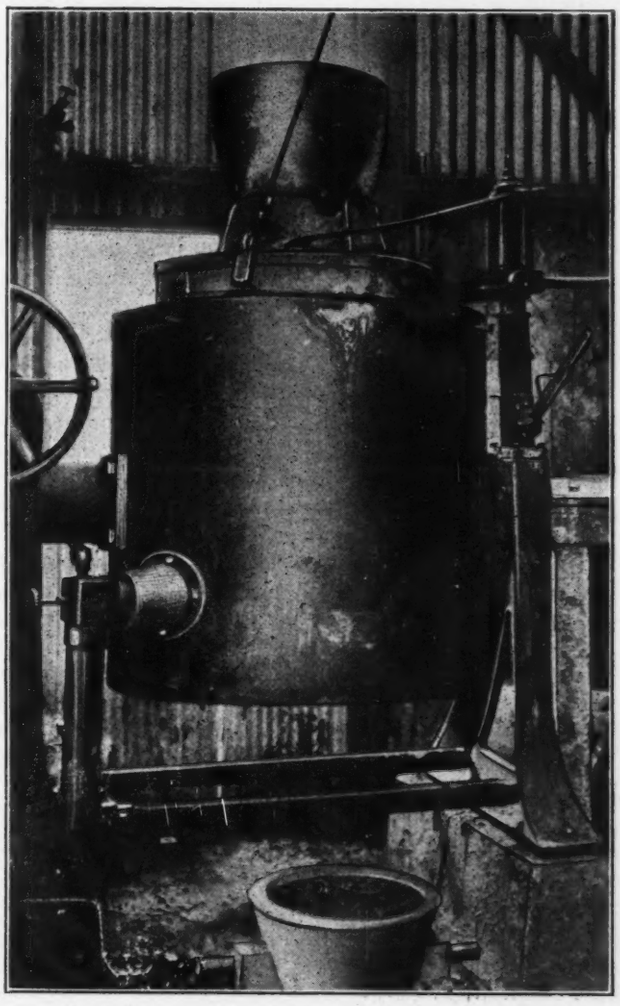
Filter-plant operators have often noted a gradual darkening of the sands in many of the plants. At first no thought was given to the phenomenon other than the fact that the beds were not clean at the time of observation, but it was found impossible to wash the sand back to its original color. Samples were submitted to the laboratory, and analyses made which showed that the dark color was due to manganese and iron. The darker the deposit, the higher the percentage of manganese.

At Osawatomie there was a striking change in the color of the sand. In a few weeks the color changed from a natural light yellow to coal black. Careful study of the basin and influent lines showed a growth of bryozoa or pipe moss. When these organisms died, the deposit of their sheaths showed a very high percentage of manganese. An analogy was drawn between this phenomenon and the fact that the muck lands of Florida, Hawaii, and other places carry an extremely high percentage of manganese, and it seemed plausible to assume that the same principles of decomposition and deposition would be maintained in a filter bed that was allowed to become foul.

Device for Charging Precipitate

At the beginning of the war nearly all the precipitate from the silver mills of Nevada was melted down in graphite crucibles in furnaces of the Faber du Faur, Steel-Harvey, or Case type. The cost of the No. 3 or No. 275 crucibles was about $12 each, f.o.b. factory; and with an output of 25,000 to 30,000 oz. of bullion per crucible, the expense for crucibles was merely nominal. Under war conditions the price of crucibles trebled, the quality decreased, and they were difficult to obtain. These adverse conditions hastened the installation of the more economical Rockwell furnaces, which used a mixture of water glass and carborundum as a lining of the reverberatory chamber.

On account of the cost of the Rockwell furnace and of the briqueting machine necessary to make it an economical installation, many of the small mills could not profitably make the change, and every effort was made to improve the practice with the old furnaces and to extend the life of the crucibles. To speed up melting, coke-fired Faber du Faurs were changed to oil-burning furnaces. To extend the life of the crucibles, the exteriors were painted with Johns-Manville "brickline"[1] to



TILTING FURNACE WITH CHARGING DEVICE

*Abstracted from a paper, by J. E. Welker and C. C. Young, read before the American Water Works Association and published in the *Canadian Engineer*.

[1] "Brickline" is a high-temperature cement mixed with water and applied with a brush.—EDITOR.

prevent the gradual oxidation of the graphite content of the crucible walls. Previously the discarded crucibles would show only a porous fire-clay exterior for a depth of ½ in. around the fire line. With the use of "brickline," the graphite remained intact, under the thin protecting skin. This gave ½ in. more life to the crucible around the slag line.

To retard the unavoidably faster corrosion of the crucible on the slag line on the No. 3 crucibles in the Faber du Faur furnaces, these crucibles were turned in the furnace with special tongs, after a few bars had been poured from one position of the crucible. In the furnaces using the No. 275 crucible, false lips were built on the opposite side to allow the crucible to be poured from an opposite side, to avoid a hole on the slag line. Patches over holes in the crucibles were made, but not with much success.

In the open-end type of crucible furnace, like the Steel-Harvey or Case, the oil flame plays around the top of the crucible, causing a draft with more or less chance of dusting. Charging the crucibles, even with all flame cut off, causes dusting, probably mostly from the sudden decomposition of the carbonate of soda on striking the hot slag. If a crucible is charged to the top with precipitate and flux, it is not sufficient to give an 1800-oz. bar and must be recharged. This gives a dusting loss and a sudden chilling of the furnace. A No. 275 crucible will easily hold two or more bars of bullion, but the charging space is correspondingly reduced. To overcome these difficulties and to speed up the melting, Frank Hobbins, superintendent of the Nevada Packard mill, devised the method of charging shown in the illustration.

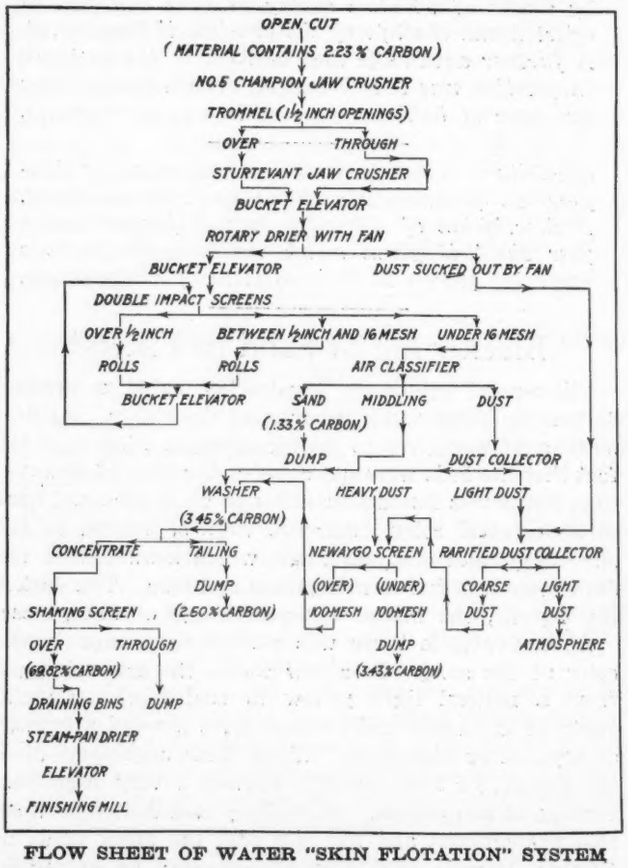
The furnace is a Case No. 275; the lid being of horizontal circular fireclay brick with a center charging hole. It is iron bound and connected to a post on the furnace with a lifting lever arrangement, allowing it to be raised and swung to one side for pouring. By cutting out the bottom of an old No. 3 crucible and sawing it off with a hack saw about 18 in. above the neck, Mr. Hobbins made a charging funnel and also a circular support for the new funnel. The charging hole in the lid was made larger by chipping it to fit the neck of the funnel. To provide for the additional weight, small cables were run from the lid, as shown in the illustration, over a sheave, to a proper counterbalance weight outside.

As soon as the original charge began to melt down, the funnel was filled with fluxed precipitate. The waste heat coming up around the funnel was sufficient to evaporate the moisture from the precipitate charge, and the heat at the mouth of the funnel was great enough to crust or fuse over the cone of precipitate extending from the funnel to the crucible charge. By this method, instead of damp precipitate being charged into the furnace, with dusting of precipitate and chilling of the furnace, a steady stream of precipitate slowly settled into the crucible, thoroughly dried and nearly at the fusion point of the fluxes.

Using this method of charging, it was advantageous to allow two bars of bullion to accumulate in the furnace before pouring. The result was a marked decrease in melting time, less heat and work for the melter, and a greatly reduced chance of dusting loss. Mr. Hobbins had data on the savings recorded with the idea of giving the information to his fellow engineers, but, his application for the officers' training camp being accepted, he entered with enthusiasm into the service of his country and later made the supreme sacrifice in the Argonne.

"Skin-Flotation" of Graphite Ores*

In the water "skin-flotation" system, a typical flow sheet of which is shown herewith, the ore is crushed dry to $\frac{1}{16}$ in. or $\frac{3}{32}$ in. It is then passed through a rotary drier, screened, and passed over an air separator, which classifies the material into three products—scalpings or tailings, which go to the waste dump; middlings, which form the washer feed; and fines, which are generally treated on a separate group of washers. The middlings plus the fines, which form 50 to 65% of the crude ore, go to a bin for fine ore, from which the material drops to surface-tension washers. In this machine, the graphite and some of the mica are floated off, on the surface film of water, while the gangue minerals are wetted by the water and sink to the hutch of the washer, which discharges to the tailings launder. The rough graphite concentrate is then dewatered on a trommel or shaking screen, which also removes both the graphite too fine to make No. 1 flake and the fine sand that has been carried over into the concentrates by the film formed by the graphite on the surface of the water. The dewatered concentrate, a dry sample of which analyzes 40 to 60% graphite carbon, is then dried in a rotary or steam-pan drier and sent to the finishing plant.



FLOW SHEET OF WATER "SKIN FLOTATION" SYSTEM

*Abstracted from Pamphlet No. 3, by George D. Dub, "Graphite for Crucible Making," War-Minerals Investigation Series.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Relief Claims Exceed $18,000,000

Claims in excess of $18,000,000 have been filed with the War-Minerals Relief Commission. Prior to midnight on June 2, when the act specifies that the docket close, in compliance with the law, 1287 claims had been received. So great was the number of claims received during the last week the docket was open that it has been impossible to calculate exactly the aggregate amount. The approximate total, however, exceeds $18,000,000.

Experience thus far shows that a large number of claims, when investigated carefully by the accountants of the War-Minerals Relief Commission, are subject to material reductions. It is regarded as possible that the reductions and rejections will be sufficient to permit payment of all claims allowed out of the $8,000,000 which will be available for that purpose.

On the night of June 2 a representative of the commission was stationed at the main postoffice, and to him was delivered each piece of mail matter arriving up to midnight. Claims are continuing to arrive, despite the expiration of the time limit, but they are not to receive any form of consideration. These claimants are being advised that their documents are being held subject to their instructions for their disposal.

The commission now is undertaking to gather additional evidence at hearings at different mining centers, for which three months will probably be required. Numerous difficult problems confront the members in administering the law. Important among them is the interpretation of the "request or demand" of a Government agency which induced the claimant to undertake his venture. The commission has promised not to make its interpretation of that feature of the law until after it has heard the oral arguments of the chrome producers. Many are of the opinion that a strict interpretation of the actual phraseology of the statute would bar out practically all, if not all, claims. It is thought that the commission will take into account the often-stated purport of the relief legislation, which is the discharge of a moral obligation on the part of the Government. If that view is taken it is believed that all claims will be admitted in the making of which it is shown that the claimant was responding to the general Government policy of stimulation. It is pointed out, however, that this policy of stimulation was not really begun until March, 1918, when the Shipping Board began its drastic restriction of imports of war minerals.

Another important question raised is that of the status of claims based on preparation of war minerals after their actual production. The most notable claim falling in this category is that of the Anaconda Copper Mining Co. That company has filed a claim for $561,346.62, and sets forth its case in substance as follows:

In January and the early part of February, 1918, certain Government officials, and particularly B. M. Baruch, then chairman of the War Industries Board, discussed with officials of the Anaconda company, and particularly with C. F. Kelley, then vice-president and now president of the company, the proposition of installing and operating a plant at Great Falls, Mont., for producing ferromanganese from Montana ores.

It was apparent to all that the construction and operation of such a plant at Great Falls would result in a distinct aid to the Government in at least three particulars—namely, the treatment of the ores produced at Butte and vicinity at Great Falls would render unnecessary the shipping of the lower-grade ores to Eastern steel plants, and thus largely economize railroad transportation; a lower grade of ore could be utilized, thus increasing the available supply of manganese; at Great Falls a large amount of hydroelectric power is generated which is used by the Anaconda company, so that less fuel would be consumed than at the Eastern furnaces and plants following ordinary methods of utilizing manganese.

In his conversations with the officials of the Anaconda company, Mr. Baruch, as the chairman of the War Industries Board, repeatedly urged and requested that the company enter upon such an enterprise. It was clear to all that the operation of such a plant would be strictly a war business, and could be conducted only during the period of the war.

The entire situation confronting the Anaconda company in connection with the installation of the plant is set forth in a letter to Mr. Baruch, which is attached to the claim. In his reply Mr. Baruch recognized the situation of the Anaconda company, but further expressed his desire that the construction of the plant be undertaken.

Thereupon the company diligently proceeded with the installation of the plant. Every energy was devoted to its early completion, at a considerable sacrifice of other important operating requirements of the company, which had to be curtailed on account of the shortage of skilled labor.

The plant was designed to include five electric furnaces with a capacity each of 15 tons per day of 80% ferromanganese. The first furnace was completed and started in September, 1918. At the time of the armistice, three plants were in operation. The other two were awaiting necessary apparatus. The early closing of the war, coming soon after the completion of the plant, resulted in the loss on which the claim is based.

Among the other large claims which came in at the eleventh hour is one for $609,429.31 by the Western Chemical Manufacturing Co., of Denver. The claim is based on a pyrites operation conducted in the Greenback mine, situated in Lake County, Colo. Edward E. Marshall, of Philadelphia, submitted a claim of $504,245.74, based largely on manganese mining activities in Cuba, Porto Rico, and Costa Rica. The United Chemical and Industrial Companies asks to be reimbursed for loss of $382,500, based on an effort to produce manganese near Crimora, Va. The Manganese Associates, a concern of Waynesboro, Va., which operated the Kennedy mine, in Augusta County, Va., has submitted a claim for $252,373.29. A. H. Jarman, of San Jose, Calif., makes claim for $138,929.51. His operation was known as the Steele Chrome Mine, in El Dorado County, Calif. The Arko Mining Co., of Minneapolis, is claimant for $100,000, as a result of manganese operations in Crow Wing County, Minnesota.

The schedule of the public hearings to be held by the commission, as announced, is as follows: St. Louis, Mo., Planters Hotel, until June 15; Little Rock, Ark., Marion Hotel, June 16-19; Tucson, Ariz., Pueblo Club, June 21-26; Los Angeles, Calif, Jonathan Club, June 27 (will remain a week or 10 days); and San Francisco.

Chronology of Mining, May, 1919

May 5—Calumet & Hecla reduces production by 50%, and 2000 employees are laid off.

May 6—Removal of restriction on export of silver.

May 7—Chiefs of the substations of the U. S. Bureau of Mines held meeting in Salt Lake City.

May 8—Spectacular rise in prices of silver to $1.03 occurred, with advances to $1.05¾ and $1.11 on following consecutive market days.

May 9—Announcement of suit between Balaklala Consolidated Copper Co. and Mammoth Copper Mining Co. for settlement on ores.

May 10—London silver price rose to 58d.

May 12—New Utah law regarding stock transactions became effective.—Silver price in New York rose to $1.19¾—Bureau of War Trade Intelligence merged into the Bureau of Enemy Trade.

May 13—All existing restrictions on the import of emery and emery ore removed.—Price of silver reacts to $1.14¾, with further decline on the following day.

May 15—Mammoth smelting works at Kennett closed down on account of labor troubles.

May 15—Fire at South Porcupine, many buildings being destroyed.

May 16—Price of copper advances to 16.10c.

May 19—Dolly Varden Mining Co., operating Dolly Varden mine, in Alice Arm district of British Columbia, and Temiskaming Mining Co. failed to liquidate claims of the Taylor Engineering Co. for construction of a railway from the coast to the mine on this date, set by the British Columbia Provincial Legislature.—Mining and Geological Exposition of the Department of the Interior opened at Washington, D. C.—Congress convened in extraordinary session—War Trade Board announced that nitrate of soda and nitrate of potash may be imported into the United States without restriction under a general import license when coming from countries with which general trade is authorized.

May 20—Operators in Coeur d'Alene district of Idaho advanced wages of miners 50c. per day to $4.75.

May 22—John Fritz Medal awarded to George W. Goethals.

May 27—Oil struck in England for the first time.

May 28—War Trade Board announced that applications would be considered for licenses to import tin ores and tin concentrates, subject to certain conditions.

May 29—Announcement that fine silver bars may be exported from Mexico during June without an export license and without the necessity of importing any percentage of gold in substitution.—Announcement by Cape Copper Co. of suspensions of mining operations of Cape Colony.

May 31—Bill introduced into Congress by Representative Raker, suspending all assessment work on mining claims during the war and for one year after peace is declared.

Gold and Silver in 1919

WASHINGTON CORRESPONDENCE

No definite or even approximate figures are available of the production of gold and silver during the first four months of 1919, and the only comparative figures on output are based on the production in 1918 as estimated by the Bureau of the Mint and the U. S. Geological Survey, which estimate was published in the *Journal* of Jan. 11, 1919.

It is evident, however, the Geological Survey points out, that conditions prevailing in gold and silver mining during January, February, March, and April, 1919, were not such as would result in any large change in the output which was being made in the latter part of 1918. Labor conditions gradually improved in the gold-mining districts, both in the number of men employed and in their efficiency. There has been a reduction in the cost of powder, drill steel, and other necessary supplies and equipment, but neither wages nor purchase prices of materials have radically declined, so that the cost of mining remains much higher than in normal times.

Greatly increased activities have been noted in all the gold- and silver-producing districts. Many mines which were inactive or operated with reduced forces have resumed work. This increased activity has not yet resulted in great increase in output, for most of the work has been confined to repairs and development, the latter having been radically reduced during the war. In many mines which sent an increased quantity of ore to the mills there was a smaller recovery per ton, which was balanced by a lower cost of production.

It is probable that the rate of refinery output of gold and silver, as distinguished from that of mines, was about equal to that during the last part of 1918, for it was good policy to refine copper and lead containing gold and silver and store the base metals while marketing the silver.

There were no important discoveries of gold properties durin, the first quarter of 1919, though there has been more activity at old mines, which will probably result in an increased yield of gold from siliceous ores. This increase, however, will not be large and probably will be more than offset by a reduced output of gold from domestic copper, lead, and zinc ores, which amounts to about $10,000,000 a year. It is estimated that copper mines have been operating at about 65% of normal capacity, and lead and zinc mines, which produce some gold, at about 80%, so that there will probably be, in 1919, a decrease of $2,000,000 to $3,000,000 of gold from such sources.

There will be, during 1919, a slightly increased output of gold from deep mines in the Juneau district, Alaska, but this will probably be offset by a decrease in gold from gravels, owing to the shortage of labor and fuel at gravel properties. There will also be increases from the gold mines in Arizona, Colorado, and South Dakota, and probably other states. These increases, however, will not be great. A conservative opinion is that the production of gold in the United States in 1919 will not exceed by any large amount that of 1918, or about $69,000,000.

Owing to the increased value of silver, there has been a renewal of operation in many of the old silver-mining districts in Colorado, Nevada, Arizona, Utah, and Idaho, but the work has been largely that of development, which promises to increase the output of silver, but which so far has not resulted in increased yield. The new Divide district in Nevada is already shipping some high-grade ore, but it will be many months before the production will reach an amount comparable to that of former years from Tonopah and other districts. Even should the greater activity at the many silver mines now reported as being worked result in an increased output of several million ounces, there is every reason to as-

sume that the output of silver for 1919 will be less than in 1918, owing to decreased ore shipments from copper, lead, and zinc mines.

Siliceous silver-gold and silver ores produce less than one-third of the production of silver in the United States. Copper ores yield slightly less than siliceous ores, and the remainder is derived from lead, zinc, and mixed ores, so that even with increased operations during the latter part of 1919 at copper mines in Alaska, California, Nevada, Utah, Montana, and Arizona, and at lead and zinc mines in Colorado, Idaho, Utah, and Montana, there will be a much smaller yield of silver from the refining of copper, lead, and zinc. These losses will be several times larger than any increase of silver from siliceous ores, and there is, therefore, no valid reason to believe that the production of silver in the United States in 1919 will exceed 65,000,000 oz., or about 3,000,000 oz. less than the production in 1918.

Southwestern Society of Engineers

The importance to the engineer of taking a larger part in civic affairs was emphasized at the convention of the Southwestern Society of Engineers held at the University Club in El Paso, Tex., on May 29, 30, and 31. It was the theme of the opening address delivered by the society's president, Dean G. M. Butler, of the University of Arizona, and was frequently stressed during the various sessions that followed.

The question of licensing of engineers was discussed by C. E. Drayer, secretary of the American Association of Engineers. A resolution approving the principles of licensing as advocated by the association was passed by the Southwestern Society, which also voted to affiliate itself with the association, the details of such affiliation to be decided upon later.

Other addresses included one upon "Oil Geology," by Dean Butler, of particular interest at this time, when new oil discoveries in the Southwest are attracting much attention. R. W. Goddard, of the New Mexico Agricultural and Mining College, had for his subject "Modern Wireless Telegraphy and Telephony."

C. E. Barglebaugh, secretary of the Southwestern Society of Engineers, who served as engineer with the Emergency Fleet Corporation during the war, discussed "The Concrete Ship."

Various resolutions were passed, one providing for the establishing of an organized employment service under the auspices of the society. On the second day of the convention the members were entertained at a luncheon given in their honor by the El Paso Mining Circle. Closer coöperation was urged between the two organizations in the interest of the development of the Southwest. Among the speakers was State Senator R. M. Dudley, who was recently active in securing the passage of a new mining law for Texas, which, however, was vetoed by the Governor.

The present officers of the Southwestern Society of Engineers were reëlected to serve until the fall session. They are as follows. G. M. Butler, Tucson, Ariz., president; S. H. Worrell, El Paso, Tex., and Gerald Sherman, Bisbee., Ariz., vice-presidents; R. W. Goddard, State College, N. M.; and C. E. Barglebaugh, El Paso, secretary. The directors are W. E. Robertson, El Paso; A. E. Barnes, State College, N. M.; James A. French, Sante Fe, N. M.; Ralph S. Moore, El Paso; D. B. Gillies, El Paso; and J. C. Ryan, Bisbee, Arizona.

Quincy-Hancock Consolidated Situation

HOUGHTON CORRESPONDENCE

The aspect of conditions respecting the Quincy-Hancock Consolidated would be considerably clarified if the Quincy absorbed the Hancock. This has been discussed among shareholders repeatedly, as it is understood it would be consistent from the standpoint of economical mining operations for both properties. However, the plan to have the Hancock shareholders authorize the sale of 125 acres of land to the Quincy is not preliminary to any such suggestion and would rather indicate that no consolidation scheme is under consideration. The territory in question could not be mined profitably by the Hancock for a long time and then only at great expense, whereas it can be handled easily by the Quincy. The price agreed upon is reported to be reasonable and gives Hancock funds enough to pay indebtedness and finance future opening operations, whenever conditions warrant.

British Import Restrictions

A concise statement of the British restrictions upon imports, with consolidated lists of prohibited imports and exceptions thereto, correct to May 1, 1919, has been prepared by the Division of Foreign Tariffs of the U. S. Bureau of Foreign and Domestic Commerce. The object is to make readily available for reference purposes accurate information regarding the conditions under which American goods are now admitted into the United Kingdom. The title of the publication is Tariff Series No. 39A (Supplement to British Control of Imports and Exports), and copies may be purchased from the Superintendent of Documents, Washington, D. C., at 5c. each.

Oil Companies Active in Arizona

PHŒNIX CORRESPONDENCE

Every quarter of Arizona has its own oil boom, even though no oil has been developed up to date. Even 20 years ago, oil wells were drilled near Phoenix, at Riverside, in the Gila Valley, in the Verde Valley near Camp Verde, and on the plain north of Agua Caliente. During the last two years there has been similar activity prospecting in the Chino Valley, west of Jerome, where two wells were started, and in the Holbrook field, where two drills are now going down and where many more are promised. The Chino field is quiet. Its home company has transferred its machinery to a Texas lease. Two other promotions have been turned over to the Corporation Commission as employing stock-selling methods needing investigation.

The Holbrook field has many mining incorporations. A number of favorable geological reports have been made on the field. The oil fever has spread in the same locality. Winslow, to the west, has organized a mutual company for drilling. At Snowflake, on the south, and near St. Johns, to the southeast, great tracts of the state lands and of lands owned by cattle companies have been leased by oil speculators. Near the New Mexican line, seventeen townships have been leased by the Bankers' Oil and Refining Co., with stipulation that a well must be sunk on each township within a year. The Adamana Oil Co., of Holbrook, has just entered the

Ventura field, in California, having purchased 810 acres, adjoining the Modello property, with several shallow wells already in heavy oil.

Tucson is the center of another oil boom, with locations made on thousands of acres in the Cienega section, to the eastward; in the Rillito Valley, to the northward, and in the Santa Cruz Valley, southward. Oil indications are said to be good for many miles toward the Mexican line. One well-capitalized Tucson company, the Canoa, with lease on the land grant of that name, has decided that its first activities are to be in the western Texas fields, this decision following volunteer reports by university geologists considered unfavorable to local drilling, but strongly combated by others who are credited with knowledge of conditions under which oil may be found. Another Tucson company, the Tu-Tex, will drill in the Tampico field of Mexico, on a basis of $117,000 subscribed, and has the approval of the Arizona Corporation Commission of plans made.

Yuma is concentrating on a home company that is to drill in the Gila Valley, east of the city, where about all the acreage for 20 miles has been covered by leases. Locations have been made also on the California side of the river, near the Lower California line.

Near Buckeye a rig has been bought by the Palo Verde company, which has leased 12,000 acres of farm land.

In nearly every Arizona town small syndicates have been formed to send representatives to Texas for leases, and several large corporations have been capitalized within the state for development of Texas lands. Beyond these speculations, possibly a million dollars has been subscribed to Texas companies. Without doubt, oil speculation has served to slow down mining development within Arizona. It also has had the effect of absorbing the labor overplus temporarily existing at the end of the war.

Colorado Engineering Council

The Colorado Engineering Council, which was organized on Apr. 12, 1919, at the University Club, Denver, held its first regular business meeting recently, and elected the following officers: Arthur Ridgway, president; L. G. Carpenter, vice-president, and R. J. Grant, secretary-treasurer. The purpose of the council is to coördinate the work of various technical, scientific, and engineering organizations, to promote the welfare and professional standing of their members, and to foster a more general recognition of the engineer in civic matters. The council plans to hold regular monthly sessions and special sessions when advisable.

The charter members of the council, and the organizations which they represent, are as follows: L. G. Carpenter and Richard A. Parker, of the engineering section of the Denver Civic and Commercial Association; L. B. Skinner and Harry J. Wolf, of the Colorado Scientific Society; H. B. Lowden and L. B. Skinner, of the Teknik Club; F. H. Dreher and C. M. Lightburn, of the Colorado Society of Engineers; R. J. Grant and R. M. Keeney, of the Denver Section of the American Institute of Mining and Metallurgical Engineers; H. S. Sands and R. B. Bonney, of the Denver Section of the American Institute of Electrical Engineers; Thomas L. Wilkinson and Frank E. Shepard, of the American Society of Mechanical Engineers; and Arthur Ridgway and E. F. Vincent, of the American Society of Civil Engineers.

Mining in Venezuela

VENEZUELA CORRESPONDENCE

The returns just received from the Callao and Guiana gold districts of Venezuela show that during the last year over 3000 deaths occurred from malaria, pernicious fevers (probably yellow), dysentery, beri-beri, and other tropical diseases.

The foreign gold-mining companies that suspended operations during the last two years are now once more preparing to begin work, but scarcity of labor will prevent a resumption of activity on a scale corresponding to that of previous years. Prompt and vigorous action must immediately be taken to improve the sanitary conditions in the region, if the potentials of the gold belt are to reach that high degree of development that prospects indicate will be remunerative.

The bauxite deposits (Eocene) that are found between the boundary of British Guiana and the delta of the Rio Orinoco are attracting attention and cover great areas. The mineral is found in beds underlying the alluvial drifts and varies in thickness from a few inches to as much as 85 ft. At certain points it has been found that the material has acquired impurities Most of these are silica- and iron-forming concretions, at places covering many acres and rendering the material commercially worthless. Core drilling is absolutely necessary to prove the export value of the material. Many possibilities in the mineral industry in this country are retarded in development by the lack of ship bottoms.

Production of Soda Ash in 1918

Sodium carbonate in the form of soda ash is the foundation of the alkali industry, for it is used in the manufacture of glass, soap, and dyes, as well as caustic soda and most other sodium compounds. It is significant that the production of soda ash was well maintained in 1918, in spite of various difficulties incident to the war and of prices that were lower than those of 1917.

The sales in 1918 were 1,390,628 short tons, valued at $35,635,520, as compared with almost exactly the same quantity in 1917, valued at $38,028,000, according to R. C. Wells, of the U. S. Geological Survey. The sales in 1916 were about 1,200,000 tons, valued at $18,000,000. These figures do not include sodium carbonate reported in the form of monohydrate and sesquicarbonate, for the production of which exact figures are not available, nor the soda ash consumed by the manufacturers in their own plants in making caustic soda and other sodium compounds. The quantity of soda ash used for the latter purpose in 1918 is estimated at 664,000 short tons, against 482,000 short tons in 1917.

Most of the domestic soda ash is made from salt and limestone, but a small quantity is made in the West from natural sodium carbonate, chiefly that obtained from the water of Owens Lake, in southeastern California. The quantity made from this source in 1918 was 19,100 short tons, valued at $971,000, against 18,800 short tons, valued at $858,000, in 1917.

The exports of soda ash in 1918 were 119,218 short tons, valued at $7,805,550. This material went principally to Japan, Canada, Brazil, Australia, and Cuba, named in decreasing order of quantity exported.

Editorials

The Flotation Decision

AT THE time of going to press last week, we had only brief summaries giving the general conclusions of the Supreme Court in the Butte & Superior case, the complete opinion at that time not having been published. We have since received the full text of this opinion, which will be found upon another page.

It appears to be established that the effect of the decision of the court in the case is to confine the patent to the use of oily substances, having a preferential affinity for metal over gangue, in any quantity less than one per cent. on the ore, in a process in which air bubbles are introduced into the ore pulp by agitation.

In this case the Butte & Superior company denies the validity of the patent and the claim of infringement, but the Supreme Court considered the new evidence on the question of validity too meager and unsatisfying to justify any modification of its previous decision in the Hyde case in this respect, and determined, in the main, only the question of infringement.

The chief controversy in tho case centered about the claim of infringement based on the use of oil by the Butte & Superior in excess of one per cent. This company had used oil prior to the Supreme Court decision in the Hyde case in quantities less than one-half of one per cent. on the ore, but after that decision, until the trial of this case, it increased the quantity of oil to in excess of one per cent., with the exception of a few weeks, when the oil used was in excess of one-half of one per cent. but less than one per cent. on the ore.

The District Court held Butte & Superior to be infringing during all of the three periods, on the theory that the practice of that company throughout involved the process of the patent—namely, the mechanical-agitation type of operation in connection with an efficient oil of the patent in the critical proportions.

Judge Bourquin, in the District Court, found that the use of a mixture of pine oil, kerosene oil, and fuel oil amounting to over 20 lb. to the ton of ore in which the pine oil was present in quantities of less than three-tenths of one per cent. of ore was an infringement, for the reason that the remainder of the mixture carrying the whole quantity over one per cent. was inert and useless, if not actually harmful.

The Circuit Court of Appeals reversed Judge Bourquin and construed the Supreme Court decision in the Hyde case as limiting the patent to the use of oil in quantities less than one-half of one per cent. on the ore. This opinion was based upon the language of the Supreme Court in the Hyde case, as follows: "The patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of one per cent. on the ore.'" The Circuit Court of Appeals considered that this language was its authority to limit the claims to one-half of one per cent. on the ore, believing that the Supreme Court had found that the "critical proportions" "often described in the testimony" were proportions "amounting to a fraction of one per cent. on the ore" and that such "critical proportions" "often described in the testimony" were by the evidence and the admission of counsel for Minerals Separation, Ltd., confined to a fraction under one-half of one per cent.

The Supreme Court has found the Circuit Court of Appeals to be in error on this point. Justice Clarke in the opinion just handed down announces the opinion of the Supreme Court to have been in the Hyde case, and to still be, that the right of the patentees should be limited by the claims. In the claims the amount of oil is stated as "a fraction of one per cent. on the ore," and as the phrase "critical proportions" is nowhere to be found in the patent, but is derived only from the evidence, it must give way to the language of the claim when it conflicts therewith. He therefore decides that the "critical proportions" "often described in the testimony" must be held to be any fraction of one per cent. as set forth in the claims. This is the only point upon which the Supreme Court reverses the Circuit Court of Appeals.

In considering the question of the use of oil by Butte & Superior in excess of one per cent. on the ore, the Supreme Court found it necessary to define the scope of the claims with respect to the kinds and quantities of oils that may be used in the process. It will be remembered that Judge Bourquin, in the District Court, found kerosene and fuel oil to be of no use in the process when used in a mixture with pine oil—the pine oil being present in a quantity sufficient in itself to produce the result of the process. The Supreme Court, on an examination of the evidence in this case, found that kerosene and fuel oil were petroleum products having preferential affinity for metal over gangue, and that petroleum products had always been considered oils of the patent by the patentees and their agents until that question had been raised by Minerals Separation, Ltd. in this case. The Supreme Court in this connection says: "Much of this evidence is especially impressive because the papers from which it is derived were written and the witnesses testified before the question as to petroleum, now made in this case, was raised or discussed."

Justice Clarke finds no justification for limiting the oils of the patent to "frothing oils" as distinguished from "non-frothing oils." He says: "To give such a construction to the patent would subordinate the clear description contained in it of what are oils of the process, to an implied and vague description and classification which would leave the whole subject again at large, to become a field for further experimentation, without definition in the patent of what oils or froths would satisfy it." In this connection he further says: "It is apparent that it makes no differentiation whatever, either in the claims or in the specification, among the oils having a preferential affinity for metalliferous matter, and that its disclosure, to which the petitioners must be limited, is, that when a fraction of one per cent. on the ore of any such oil is used in the manner

prescribed, there will be produced a metal-bearing froth, the result of the process. No notice is given to the public, and it is nowhere 'particularly pointed out' in the claims, that some oils or combination of oils, having a preferential affinity for metalliferous matter, are more useful than others in the process, or that some may be used successfully and some not, or that some are 'frothing oils,' a designation not appearing in the patent, and that some are not. The patentees discovered the described process for producing the result or effect, the metal-bearing froth, but they did not invent that result or froth—their patent is on the process; it is not and cannot be on the result—and the scope of their right is limited to the means they have devised and described as constituting the process." He concludes that the only disclosure as to the kind and amount of oil which the patentees made to the public as necessary to the practicing of their process is that it must be an oil or oily substance, or oily liquid having a "preferential affinity for metalliferous matter," and that it shall be limited in amount "to a fraction of one per cent. on the ore."

Though the Supreme Court considered the claims only with respect to the amount and character of the oil prescribed, it seems clear that the remainder of the process is that described in the decision of the Supreme Court in the Hyde case. As will be seen from the excerpt from the opinion above, "the patent is on the process—it is not and cannot be on the result—and the scope of their right is limited to the means they have devised and described as constituting the process."

In this connection it is interesting to note that Justice Clarke finds, after setting forth the disclosure of the patent with respect to the kinds and quantities of oils which may be used in the process, that: "The only additional statement contained in the specification, which is in the nature of a disclosure, is found in the description of the example of the application of the invention, in which it is stated that the 'froth or scum' derives its power of flotation mainly from the inclusion of air bubbles introduced into the mass by agitation, such bubbles or air films adhering only to the mineral particles which are coated with oleic acid." It can be concluded from this that "The inclusion of air bubbles introduced into the mass by agitation is part of the disclosure"; then it may be assumed that the patentees are limited to this means of "inclusion of air bubbles" as being "the means they have devised and described as constituting the process."

It is apparent from an examination of the typical claim quoted in the Supreme Court opinion that if one removes those words relating to the element of oil, the other elements of the process remaining are, first, "mixing the powdered ore with water," and, second, "agitating the mixture until the oil-coated mineral matter forms into a froth." In this view of the claims, it seems to us extremely doubtful that the Supreme Court would hold the pneumatic or bubble-column process to be covered by this patent. There is involved in such process the "mixing powdered ore with water" and "the adding of a small proportion of oily liquidation having a preferential affinity for metalliferous matter (amounting to a fraction of one per cent. on the ore)," but there is admittedly no "agitating the mixture until the oil-coated mineral matter forms into a froth." Such agitation as takes place is, according to the Circuit Court of Appeals in the Miami case, "not even approximately the agitation of the patent," and is the result of and not the cause of the introduction of air[1]. To say the least, this question is still an open one and leaves much of interest in the Miami case.

The decision, however, so far as Butte & Superior is concerned, makes that company liable for an accounting for its profits, over and above what it could have made by the process of the prior art, an amount which would be determined by the profits which it has made as compared with a standard of comparison based upon the use of oil in excess of one percent.

The Latest Mine Holocaust In Pennsylvania

ON JUNE 5, in the Baltimore tunnel of the Delaware and Hudson Coal Co., 83 men were killed and 50 more burned and maimed. According to the account, these men were miners going to their working places two miles from the mouth of the tunnel. The men were taking the trip in a train of 14 mine cars drawn by an electric motor, two of the cars in the middle of the train containing powder, presumably for the day's operations. It is said that the accident resulted from a short circuit caused by the trolley wire coming into contact with one of the steel kegs containing the powder.

Such a holocaust may well cause mine managers and mining engineers intense regret that the obvious carelessness of handling large quantities of explosives and men in close proximity still persists. Similar accidents have taken place in the metal-mining industry. We recall the accident at the collar of the Granite shaft, in Butte, and one in the open pit of the Nevada Consolidated, in Nevada. In both relatively large quantities of explosives were ignited accidentally when men were about, and a number of fatalities resulted.

It is a well-known rule in metal-mining practice to bring explosives into a mine at times when miners are not present. The handling of both men and explosives on the same cage at the same time is prohibited. In adit workings, explosives are handled on separate trains and only the trip riders are allowed to accompany the train.

The handling of relatively large quantities of explosives, particularly in coal mining, cannot be avoided. The inert character of black blasting powder—its comparative immunity to ignition through shock—undoubtedly causes a certain amount of carelessness in its handling. The unexpected is always happening, and in the accident under review a greater number of fatalities resulted than is usual. This is another expensive lesson that emphasizes the need for extreme care.

The transportation of workers and explosives in the same train should be absolutely prohibited. In the transportation of powder in separate trains, covered cars of such a type as to prevent all possibility of contact of the live trolley wire and the load should be designed and used. The time is opportune for a thorough study of the conditions under which powder is handled underground and for the drafting and enforcement of rules which will reduce to a minimum the liability of accident and prevent all possibility of the recurrence of an accident of this magnitude.

[1]See *Eng. & Min. Jour.* Vol. 104, No. 22, Dec. 1, 1917, p. 956.

The recent Pan-American conference held in Washington was the second important meeting of the representatives of the republics of the Western Hemisphere having for its objectives the promotion of better understanding, coöperation, and the improvement of trade conditions. The mutuality of interests between the Latin Americans and the United States has received substantial recognition and will be stimulated by conferences of this kind. Some of the important subjects considered were the establishment of improved communications between the United States and the Latin-American republics; the securing of a common code of business methods among the republics; the working out of satisfactory financial arrangements; international agreements for the protection of patents, trademarks and copyrights; extension of trade; improvement of consular offices, standardization of consular invoices and fees, and annulling of local laws and tariffs detrimental to general trade expansion; improvement of banking facilities and the more complete interchange of publicity and news among the republics. The great variety of the questions involved indicates the international difficulties that must be thrashed out before a large volume of trade can be established among the countries of this hemisphere. A conference such as this has the advantage of giving the participants a bird's-eye view of the critical questions and may be expected to initiate action in the various countries toward the removal of trade obstacles.

Apparently a vigorous effort is being made by the New York District Attorney's Office to run down brokers and others who are selling to the public fake oil and other stocks of dubious value. According to latest accounts, the local Grand Jury has conducted an inquiry which may result in indictments of several promoters. From Washington comes news of the activities of the Federal Trade Commission, and it is said that scores of complaints have been drawn and that a number of oil companies are involved. This is commendable work, and we hope that it will bring results. Concerted action by the various authorities charged with ferreting out fraudulent enterprises will materially help the present situation. In the end it will greatly benefit legitimate enterprise in mining and in the petroleum industry. It will also tend to make the small investor more cautious. There is a good future for investments, but the success of many worthy ventures will inevitably be jeopardized if fictitious values are created by wilful misrepresentation.

BY THE WAY

The following is a bill of sale for a burro sold by one old prospector to another at a decadent mining camp "back in the hills": "Sold to R. H. Jones one lineal descendant of Christ's conveyance into Jerusalem for the sum of seventeen ($17.00) cash in hand. His age is unknown to the present generation, color twilight, guaranteed to be perfectly tame and docile, and easy to catch if hand-cuffed and chained to a mountain; otherwise it is easier to catch four aces. It is also guaranteed that he is the identical jackass selected by the Democratic party for its political emblem so that the country might have a true and correct index of its great vocal and oratorical powers and the high intelligence of its voters."

Pat Murphy had the name of being the biggest eater on the Comstock range, reminisced Dan De Quille in "The Big Bonanza." He was a very good sort, and tried his best not to make his appetite conspicuous, but it was a thing that could not be concealed. One morning a tall, gaunt, middle-aged man came edging into the restaurant, and meekly took a seat. The landlord rather liked the appearance of the new customer, and at once went to take his order. "Landlord," said the man, "let me have a porterhouse steak and onions, some liver and bacon on the side, six fried eggs, a bit of ham, a Jarman pancake, some fried pertaties, a cup of coffee, and a couple of doughnuts, and, if ye have them, a couple of waffles." It was Pat Murphy!

"So th'art complainin' baout tha 'igh cost o' livin', m'son," said Cap'n Dick. "Dam-me, do seem as 'ow a man never naws w'ere 'e's too, an' this 'ere business o' tryin' to satisfy tha 'ol worl' be a gert 'uge contrac'. Supposin' naow tha price o' food gaws daown, thee can depen' on ut, m'son, that daown will gaw the wages. Take tha case o' one o' these 'ere Finns workin' to Lucknow mine—w'y, dam me, 'e's over in 'ospital naow cursin' tha day 'e wuz 'it by one o' these 'ere drops in food stuffs. 'Pears as 'ow this 'ere chap wuz workin' at tha station 'o tha timber shaf', sawin' h'up bunch o' laggin' for 'is contrac'. 'Baout this time one o' these 'ere 'ogs belongin' to some h'Austrians 'o wuz squattin' near the mine 'appened 'long, as 'eart-free an' unmin'-ful as you please. Bloody little cared 'e w'ere 'e wuz gawin' till all o' a sudden down 'e gaws through shaf' —'ead, tail, two 'underd paoun' o' pork, right on top o' this 'ere poor Finn chap 'o wuz workin'. Dam-me, I don't see 'ow 'e pulled through, but do seem as 'ow some chaps can't be daowned. So, m'son, thee mus' see that some o' we better be bloody well satisfied that food stays on 'igh." D. E. A. C.

When an experienced mining engineer gets the habit of the tired business man, known as the "dictated-but-not-read" policy, the results are apt to be, to say the least, disconcerting, as may be judged by the following: An otherwise perfectly good report on a Mexican mining property was available for a short time, so the engineer dictated a few paragraphs to accompany other data with a proposition that he was in a hurry to submit to a well-known mining organization. The pretty little typist was willing and ingenious, but she was rather inexperienced when it came to geological nomenclature. The result ran like this: "Underlying all formations we find a rock that forms the coast frames. It is a costly crystalline rock, locally known as cranito. To the north is a dark green rock, at times showing perplyritic structure. Further south the predominating rocks are volcanic toughs and breeches ejected from vents, the andysitic breeches being most favorable for ore deposition. The mountain frame rises abruptly from the broad Maysie flats, which, though apparently on the level, have a nearly uniform 2 per cent. rate. They are drenched by the streams, whose diverting branches have cut broad and shallow vallies in the Basil mountain slopes and concentrate in drunk channels a hundred feet or less below the level of the plain."

Personals

Rudolf Gahl is in New York.

Marshall D. Draper, sails from New York on July 1, to be engaged in exploration work in the Orient.

William B. Franklin has been elected president of the Nitrate Agencies Co., succeeding **J. L. Schaefer.**

Oscar G. Hershey, geologist for the Tom Reed Gold Mines Co., recently visited that company's property at Oatman.

A. Valjean, publicity manager, Arizona Chapter, American Mining Congress, is spending 30 days in the Ranger oil fields of Texas.

George Kingdon, general manager, United Verde Extension Mining Co., has returned to Jerome from a short business trip to Los Angeles.

L. C. Shattuck, manager Shattuck Arizona Copper Co., is visiting the Yuma section, where he has extensive land and cotton interests.

Robert E. Tally, assistant general manager, United Verde Copper Co., has returned to his headquarters at Jerome, from a trip to California.

Hywell Davies, U. S. Labor Administrator for Arizona, with headquarters at Phoenix, is making a tour of the mining camps of the state.

H. K. Masters, of the ore department of W. R. Grace & Co., was recently elected a member of the board of managers of the New York Metal Exchange.

John E. Penberthy, superintendent of the Shannon Copper Co. interests at Gleeson, Ariz., has returned from a trip of mine examinations in New Mexico.

Victor C. Heikes, of the U. S. Geological Survey, has returned to his headquarters at Salt Lake City, after making a tour of all the mining camps of Arizona.

Scott Turner has been appointed consulting engineer of the Mining Corporation of Canada, Ltd., with offices at the Bank of Hamilton Building, Toronto, Canada.

James S. Douglas, president, United Verde Extension Mining Co., of Douglas, Ariz., has returned home from a trip of inspection of the Verde X mine and smelteries at Jerome.

A. G. Burrows and **Percy Hopkins,** of the Ontario Bureau of Mines, are making an examination of the Boston Creek gold district, a detailed map of which will be issued.

Walter Douglas, president Phelps Dodge Corporation, of New York, has completed a tour of inspection of the various Phelps Dodge properties in Arizona, New Mexico, and Sonora, Mexico.

D. E. A. Charlton, of the editorial staff of the "Journal," left New York on June 7 on a trip through the Michigan and Minnesota iron and copper ranges in the interests of the "Journal."

Arthur Notman and **W. B. Gohring,** superintendents respectively of the Copper Queen and Calumet & Arizona mines at Bisbee, recently combated for the tennis championship of Arizona.

J. A. Burgess, of Oatman, Ariz., until recently superintendent of the United Eastern Mining Co., has been promoted to the position of general manager, with headquarters at the same place.

Rush T. Sill, of the firm of Sill & Sill, consulting mining engineers, Los Angeles, is leaving Seattle on June 14 for the Willow Creek district, Alaska, where he will be engaged in making mine examinations.

H. C. Henrie, chief clerk of the Copper Queen Branch of Phelps Dodge Corporation, accompanied by his wife and son, is spending a month in New York City and Pennsylvania.

Frank D. Adams, dean of the faculty of applied science at McGill University, Montreal, has been appointed acting principal of the university during the absence of Sir Auckland Geddes, who has been given a year's leave.

P. B. McDonald, who for two years has been head of the department of engineering English in the University of Colorado, has been appointed assistant professor of English in the school of engineering, New York University.

A. H. Hubbell, news editor of the "Journal," returned to New York on June 5, having completed a nine-weeks' trip through the important mining districts of the United States and several in Canada in the news interests of the "Journal."

H. Kenyon Burch, consulting engineer, Phelps Dodge Corporation, has returned to Warren, Ariz., from a trip to California. Mr. Burch has charge of the erection of the new concentrator plant near Warren, to treat the ores from Sacramento Hill.

C. H. Clapp, president of the State School of Mines in Montana, has been appointed director of the Montana State Bureau of Mines and Metallurgy, recently authorized at the last session of the State Legislature. **H. P. Pulsifer** is metallurgist and **A. E. Adami** is engineer in charge.

Capt. E. G. Snedaker, 4th Engineers, detailed as adjutant to military commander, Coblenz, Germany, writes under date of May 20 that he expects to leave for the United States soon. He may be addressed care of M. M. Hamma, 425 First National Bank Bldg., Denver, Colorado.

L. D. Ricketts, of Warren, Ariz., who during the absence of **Col. John C. Greenway** in France has had charge of the management of the Calumet & Arizona properties in Arizona, is at present visiting the East. During the summer Dr. Ricketts will spend a part of his time with his family at Santa Barbara, Calif., at the El Marisol Hotel.

Mark L. Requa, general director of the oil division of the U. S. Fuel Administration since the beginning of the war, has resigned from that post to become associated with the Sinclair petroleum interests. It is reported Mr. Requa will become vice-president of the Sinclair Consolidated Oil Corporation, which was until recently the Sholan Company.

Maj. William H. Brophy, until recently manager of the Phelps Dodge Mercantile Co., who served with the Red Cross organization in France during the war, has resigned his position with the mining company, and will hereafter devote his entire time to his extensive mining, banking, and city-utility interests throughout Arizona, New Mexico, and Western Texas.

Charles M. Schwab was presented with a solid-gold medal, in recognition of his distinguished war services, by the citizens of Bethlehem, Penn., at a meeting on May 15. The face, in sunken cross panel, shows the manufacture of steel in the Bethlehem plant during the war. The obverse side has three panels, two of which illustrate the city. The cost of the medal is said to have been more than $1000.

R. D. Hall, who has been associate editor of "Coal Age," succeeds **Floyd W. Parsons,** resigned, as editor of that journal. Mr. Hall, associated with Mr. Parsons, has been with "Coal Age" since its inception, nearly eight years ago. As announced in last week's issue of the "Journal," Mr. Parsons has assumed an important editorial position on the staff of the "Saturday Evening Post," conducting a business and science department.

J. W. Gray has assumed the editorship of "Iron and Steel of Canada," which until now had been jointly edited by **Dr. Alfred Stansfield** and **W. G. Dauncey** since its inception in February, 1918. Mr. Gray was educated in England and is a member of the Institution of Mining Engineers. Until recently he was assistant to the general manager, Dominion Steel Corporation, and then assistant to the president. Nova Scotia Steel and Coal Co. The editorial and printing offices have been removed to Ste. Anne de Bellevue, Canada.

Lieut-Col. John C. Greenway, general manager of the Calumet & Arizona Mining Co. and New Cornelia Copper Co., at Ajo, who recently returned from France, has been granted an extended leave of absence by the directors of his companies, that he may regain his health. It will be remembered that Colonel Greenway served with distinction in France, winning two rapid promotions and a citation for gallantry in action at the battle of Chateau-Thierry and later engagements, before falling a victim to German poison gas, from the effects of which he is slowly recovering.

Obituary

Wilmot D. Matthews, of Toronto, president of the Consolidated Mining and Smelting Co.. of Canada, died on May 24, from an attack of pneumonia, in the 70th year of his age. Mr. Matthews was one of the leading financiers of Canada, and was closely identified with a large number of industrial and commercial enterprises. He was president of the Canada Foundry Co., of Toronto, of the Kingston & Pembroke Ry., and a director of the Canadian Pacific Ry., the Steel Co. of Canada, and several other companies. Mr. Matthews took an active part in public affairs and had held office as president of the Toronto Board of Trade and Toronto Corn Exchange. He is survived by two sons and two daughters.

Maxwell Wanton Atwater, general manager of the Davis-Daly copper properties, died recently at the Mayo Brothers' Sanatorium, in Rochester, Minn. Mr. Atwater was born at Millville, N. J., in 1878, and attended the Colorado School of Mines from 1897 to 1901. He was connected with the Liberty Bell Gold Mining Co., Telluride, Colo., in 1901 to 1903; United Elkhorn Mines, Oregon, as superintendent, in 1904-5; Atwater, Linton & Atwater, mining engineers, Montana, as junior partner in 1905, and Butte & Superior Copper Co., Ltd., Butte, Mont., as general superintendent, 1909 to 1912. During 1913 he was engaged in general examination and exploration work. In 1914 Mr. Atwater became president and manager, Basin Salvage Co., and later president and manager, Alta-Montana Mining Co. In 1918, Mr. Atwater was appointed manager of the Butte & Plutus Mining Co., in the Philipsburg district of Montana.

Societies

American Institute of Chemical Engineers will hold the 11th semi-annual meeting in Boston, June 18 to 21. The program includes an unusally complete symposium on electric furnaces, which will consume practically all of the time on the opening day. The moving pictures of these furnaces will give a good conception of their operation. The smoker, in the evening at the A. D. Little Laboratories, is expected to be both entertaining and instructive. A trip in Boston Harbor has been planned for June 19, with visits to a number of important industries, followed by a sail to Marblehead and dinner at the Eastern Yacht Club. June 20 will be spent at the Boston "Tech." visiting the laboratories and listening to a program of papers, including an unusually complete description of the Providence gas plant, and a symposium on the registration of chemists. During the afternoon the Harvard laboratories will be visited, followed by an automobile trip through Boston, ending at the Brookline Country Club, where a dinner will be served and the evening spent. On June 21, the textile mills at Lawrence will be visited, followed by another auto trip.

The Chemists' Club announces through its scholarship committee that the Bloede and the Hoffmann scholarships will be awarded for the academic year 1919-1920. These scholarships were founded by Victor G. Bloede, of Baltimore, and William F. Hoffman, of Newark, with the object of giving financial assistance to deserving young men, to obtain an education in the field of industrial chemistry or chemical engineering. These scholarships will be open to properly qualified applicants without restriction as to residence, and may be effective at any institution in the United States which may be designated or approved by the scholarships committee. Applicants must, as a minimum qualification, have completed a satisfactory high-school training involving substantial work in elementary chemistry, physics, and mathematics, and present a certificate showing that they have passed the entrance examination requirements of the college entrance examination board or its equivalent. Preference will be given to young men who have supplemented these minimum qualifications with additional academic work, especially in subjects which will form a suitable groundwork for the more advanced study of applied chemistry and chemical engineering. All inquiries should be addressed to the Scholarships Committee of the Chemists' Club, 52 East 41st St., New York City.

Industrial News

The Betson Plastic Fire Brick Co., Rome, N. Y., was recently incorporated. Frank J. Jewell was elected president and secretary, and Nelson Adams, vice-president and treasurer. The company's products are plastic fire brick for boiler furnace linings and baffle walls and "Hi-Heat" cement for use in the boiler room.

The Electric Furnace Co., Alliance, Ohio, has just shipped one of its standard nose-tilting type furnaces to the U. S. Navy

Yard at Washington, D. C., to be used in the Government brass foundry there. This furnace is provided with a motor-operated tilting mechanism and has a maximum hearth capacity of 2000 lb. The shell is 7 ft. in diameter, and the furnace is rated at 105 k.w. capacity.

Chicago Pneumatic Tool Co. announces that J. W. McCabe, who until recently has been district manager of sales for the company at Buffalo, N. Y., has been appointed special representative for the company's foreign trade department and will depart soon for an extended trip throughout the Orient, Philippine Islands, and Australia. W. H. White has been appointed acting district manager of sales at Buffalo, to take charge of that territory during Mr. McCabe's absence.

William B. Scaife & Sons Co., of Pittsburgh, announces the opening on July 1 of a Chicago sales and engineering office at 38 South Dearborn St., with Charles F. O'Hagan, formerly chief engineer of the company at Pittsburgh, as resident engineer and manager. The business of this company is the manufacture of black or galvanized, riveted, brazed or welded steel tanks for air, gas, and liquids, steel shipping drums, range boilers, and steel structures; also the We-Fu-Go and Scaife water softeners and filtering equipment.

The Metal & Thermit Corporation, New York, has recently successfully completed the largest marine weld ever recorded, on the cast-steel sternframe of the huge U. S. Army Transport "Northern Pacific." The section welded was entirely broken through as a result of the severe strain to which the frame was subjected when this transport, laden with homeward-bound troops, ran aground on Jan. 2, 1919, in a dense fog off Fire Island, New York. The sternframe was broken just above the upper rudder lug, in a position where the casting was hollow and measured almost 2 ft. in diameter. The walls of the casting at this point were about 3 in. thick. The weld, which required 1400 lb. of "thermit" for the chemical production of the necessary amount of molten steel, and which was made without removing the casting from the ship, obviated the delay and expense which would have been entailed by the only alternative of purchasing a new casting and installing it at a cost probably exceeding $5000.

Westinghouse Electric and Manufacturing Co.'s Works, East Pittsburgh, Penn., were visited recently by the French Commission, consisting of engineers, railway operators, and government officials, who arrived in Pittsburgh from Altoona, Penn., to familiarize themselves with the operation and manufacture of electric-railway equipments. The commission spent several days in Pittsburgh, inspecting electric locomotives being built for the New York, New Haven & Hartford R.R. Co., for operation on the New York Connecting Railway across the Hell Gate Bridge. They also inspected one of the 10 new passenger electric engines which are being built for the Chicago, Milwaukee & St. Paul R.R. These will be the most powerful locomotives running in passenger service, each of the 10 having a capacity sufficient to haul 950 tons (12 steel cars) over the entire mountain section at the same speed as called for by the present schedule. The commission were the guests of E. M. Herr, president of the Westinghouse Electric and Manufacturing Co., during the members' stay in Pittsburgh.

Trade Catalogs

The Dorr Co., New York and Denver, has published Bulletin No. 13 describing the Dorrco pump. This is a 16-page bulletin containing tables of dimensions, weights, capacities and giving other pertinent information, part lists, instructions for operating and illustrations.

Heating, Ventilating, Drying, Blast Equipment. Massachusetts Blower Co., Watertown, Mass. Condensed bulletin; 9 x 11; 8 pp.; illustrated. Contains general data on fans, blowers, heaters, air washers for heating, ventilating, purifying, and cooling, air conditioning, forced and induced draft, commercial drying, and blast equipment.

Standard Apron Conveyors. The Jeffrey Manufacturing Co., Columbus, Ohio. Catalog 259; 75 pp.; illustrated. Descriptive of installations showing standard steel and wood apron conveyors in service in various industries, giving specifications, general dimensions and other important data of vital interest to the purchaser. The conveyors, both of steel and wood flights, are so arranged in this book that not only the engineer, but the layman can select a conveyor which will meet his requirements. On pages 4 to 9 are important notes to aid the purchaser in selecting a conveyor. The purpose is to save the time and expense heretofore required in making drawings and layouts for the purchaser's particular needs.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Air-Lift Pump. Levi T. Edwards, Philadelphia, Penn., assignor to Talbot Air Lift Co. (U. S. No. 1,302,780; May 6, 1919.)

Aluminum—Process of Soldering Aluminum. Armand Henri Alexandre, Levallois-Perret, France, assignor to Société E. H. Moll & Cie, Paris, France. (U. S. No. 1,301,633; Apr. 22, 1919.)

Aluminum Compounds, Process of Producing. Oystein Ravner and Victor Moritz Goldschmidt, Christiania, Norway, assignors to Det Norske Aktieselskab for Elektrokemist Industri, Norsk Industri-Hypotekbank, Christiania, Norway. (U. S. No. 1,302,852; May 6, 1919.)

Blast Furnace. Charles Henry Bingham, London, England. (U. S. No. 1,303,155; May 6, 1919.)

Blasting—Shot-Hole Scraper and Tamper. John H. Bitz, Mount Pleasant Township, Westmoreland County, Penn. U. S. No. 1,302,127; Apr. 29, 1919.)

Drilling—Well-Drilling Machine. William L. Dayton and John M. Scott, Fort Worth, Tex. (U. S. No. 1,301,915; Apr. 29, 1919.)

Drilling Apparatus. George H. Gilman Claremont, N. H., assignor to Sullivan Machinery Co., Claremont, N. H. (U. S. No. 1,303,790; May 13, 1919.)

Drilling Apparatus. Mahlon E. Layne, Houston, Tex. (U. S. No. 1,302,058; Apr. 29, 1919.)

Drilling Appliance. Frank M. Dale, Sullivan, Ind. (U. S. No. 1,301,395; Apr. 22, 1919.)

Electric Furnace. Henry Arnold Greaves and Harry Etchells, Sheffield, England. (U. S. No. 1,301,932 and 1,302,788; Apr. 29, and May 6, 1919.)

Iron and Steel, Manufacture of. George Arthur Jarvis, Wellington, England. (U. S. No. 1,303,799; May 13, 1919.)

Lamp—Acetylene Lamp. Augie L. Hansen, Chicago, Ill., assignor to Justrite Manufacturing Co., Chicago. (U. S. No. 1,303,658; May 13, 1919.)

Lamp—Acetylene Lamp. John D. Luttrell, Benton Harbor, Mich. (U. S. No. 1,302,393; Apr. 29, 1919.)

Editorial Correspondence

SAN FRANCISCO, CALIF.—June 3

Fire at the Argonaut Mine, in Amador County, is now under complete control, and milling operations have been resumed. The fire is confined to the areas between the 4350 and 4050 levels, and although all danger of the fire breaking out again is past, care must be exercised in watching bulkheads for escaping gas. The amount of caving in the burned area is not as great as expected. The ore for the present is being drawn from the 4500 level.

California Oil and Gas Supervisor will hereafter issue the annual report in monthly chapters, which will more promptly give the details of all work passed upon by the engineer staff of the State Mining Bureau. The purpose announced by Supervisor McLaughlin is to aid operators in more promptly correcting errors on part of the Bureau or the well owner. The monthly chapters will be mailed to assessment payers, agents of operating concerns, and others interested. The weekly press reports will be continued to newspapers interested.

DENVER, COLO.—June 7

Colorado School of Mines held its annual commencement at Golden on May 23, 1919. Thirteen men were graduated. A silver cup, presented by Prof. Ziegler for scholastic attainments, activity in athletics and leadership in the student body, was awarded to Guy E. Miller, of Cañon City. The Wolf medal for high scholastic attainment was won by Thomas B. Romine, of Walla Walla, Wash. The commencement address was delivered by Edwin S. Church, president Wellman-Seaver-Morgan Co., of Cleveland, Ohio. Mr. Church discussed foreign trade, labor conditions, and industrial organization, and gave the graduating class much good advice designed to be of service to young men about to enter professional and commercial life.

Railroad Administration seeks to legalize a Colorado order issued some months ago, setting aside the established ruling that shippers may release liabilities upon values exceeding $100, carrying insurance to meet losses. It is understood that the innocent-looking order asked for, apparently to cover only Colorado and district territory, is to be applied extensively over the West if finally authorized. In response to a petition from the American Mining Congress, Chairman Johnson, of the Western Freight Traffic Committee, has postponed hearings on the question of fixing new rates for ore between Western points until June 13, and arrangements have been made whereby the Colorado chapter of the American Mining Congress will be represented at the Chicago hearing, and individual and corporate representation have been invited. The outcome is considered of great importance to the mining industry, as under the proposed order the freight rates on many ores, concentrates, acids, and powders, now burdensome, would be greatly increased. The proposed increase is 1% of value exceeding $100 per ton, based on smelter or sales statements. In addition to the financial interests involved, it is feared that the proposed ruling would prevent the Railroad Administration from declaring a rate that might be necessary to keep industries and communities alive.

SALT LAKE CITY, UTAH—June 6

Opening the Uintah Basin, a section which can best be reached by the extension of the Moffatt road from Colorado, is a question which is again before the public. The plan is to form a union of Colorado and Utah capital for furthering the enterprise. Governor Bamberger, who has been in Denver informally consulting with business men in that city, is now on the way to the Uintah Basin, where, in company with other Utah men, he will make a study of the resources of that section, to determine whether they are sufficiently developed to warrant the construction of such a road. Iron deposits east of Park City, coal deposits at Red Creek, oil and oil-shales in the eastern end of the district, gilsonite deposits, and others will be examined. With Governor Bamberger on the trip, which is to last about 10 days, are R. C. Gemmell, S. R. Inch, A. N. McKay, C. C. Richard, O. J. Stillwell, of Ogden, and T. W. Clyde. The proposed road, passing from Colorado into and through the Uintah Basin, will terminate in Salt Lake. Another way to open the Uintah Basin section, which has the approval of many Utah men, would be to extend a branch railroad northerly from some point in Utah on the main trunk line of the Denver and Rio Grande.

The Tintic Milling Co., a pioneer in seeking and finding the solution for the treatment of the siliceous ores of the Tintic district, has passed entirely into the hands of the Knight interests, whose mines have furnished the greater part of the tonnage treated. George H. Dern, manager of the company since the beginning of operations, about four years ago, and financially interested in the enterprise, has sold out his stock to the Knights, retiring from the company. He is succeeded as manager by John S. Smith, formerly manager of the Knight Woolen mills, at Provo. Theodore Holt, associated with Mr. Dern in the Mines Operating Co., which treated stope fillings from the Ontario Silver mine, at Park City, and later with the Tintic Milling, continues as superintendent in charge of the Silver City plant. The Tintic Milling is practically a consolidation of the Mines Operating Co. and the Knight-Christensen Metallurgical Co., and the present plant, situated near the site of the old Knight smeltery, was built at a cost of about $200,000. It is treating about 200 tons of ore daily by the Holt-Dern roasting process and producing an average of $60,000 worth of silver bullion monthly. The ore is coming from the Dragon, Iron Blossom, Colorado, Mammoth, and Empire mines, and some smaller properties. It is expected that improvements and additions will be made so as to permit of the treatment of a larger tonnage.

WALLACE, IDAHO—June 5

Non-assessable Mining Companies will be interested in a case recently decided in the district court of Shoshone County. The Sabina Mining and Milling Co. was incorporated in 1912 with 1,000,000 shares of non-assessable stock. The entire capitalization was turned over to the owners of the ground to be developed, the owners turning back 400,000 shares to the treasury as a working capital. One of the owners, John Melander, first refused to enter the deal, but finally consented to do so under a specific agreement that his stock should "forever remain fully paid up and non-assessable." The property was developed to a considerable extent through the sale of treasury stock. About a year ago, the company being unable to raise further funds in that manner, a meeting of the stockholders was called, and, by a vote representing more than two-thirds of the issued stock, the bylaws of the company were amended making the stock assessable. Melander held 156,000 shares and voted them against the change. An assessment of 3 mills per share was forthwith levied. Melander refused to pay his assessment and in due course his stock was sold in default of payment. Melander brought suit against the company to recover his stock and $7500 damages. On the showing that Melander had been specifically assured that his stock should be forever fully paid up and exempt from assessment, the court gave him the decision, ordering the company to reissue his stock and pay him nominal damages in the sum of $100.

Decision of the Supreme Court of Idaho in the case of the Independence Placer Mining Co. is of unusual interest to prospectors and others holding mining claims of which the boundaries are irregularly defined as viewed from a strict construction of the law. The Independence company has for many years held a group of placer claims near the old camp of Moose City, in Clearwater County. In 1916, Jack Moore and W. R. Simons, acting for themselves and others, located claims over the Independence ground, and the latter brought suit. The case was transferred to the district court of Kootenai County for trial, which resulted in a decision in favor of the Independence company. Appeal was taken to the state Supreme Court, which has now affirmed the decision of the lower court. Various contentions were made by the defendants in support of their right to relocate the ground, but the only claim discussed and passed upon by the Supreme Court was that the description of the Independence locations was not made with sufficient accuracy to identify their boundaries and that the complaint did not show that the ground was properly located as required by the laws of the United States and of the State of Idaho. Passing upon this point, and basing the decision upon it without discussing other evidence submitted, the court, in affirming the decision of the lower court, said: "Mineral deposits are frequently discovered in the wilderness, remote from a government survey. These discoveries are usually made by men who are not equipped with proper instruments, nor possessed of sufficient education, to enable them to correctly run lines, make measurements, and accurately describe the ground sought to be located. Some of these difficulties, at least, attended the location of respondent's claims. In such a case the law does not exact the impossible, but the rule has been thus stated: 'If, by any reasonable construction, in view of the surrounding circumstances, the language employed in the description will impart notice to subsequent locaters, it is sufficient.' Tested by this rule, respondent's notices are sufficient."

MARQUETTE, MICH.—June 4

Iron-Ore Shipments from this port show a marked falling off during May, and indicate that the season's tonnage will show a big decrease. This is made more probable by the fact that June opens in a manner no more lively than May and there is nothing in the situation at the moment to indicate that the shipments will increase greatly in volume. To date this year the Lake Superior and Ishpeming dock at Presque Isle has loaded 114,000 tons of ore. At a corresponding time last year the movement from the dock had been 380,000 tons, or well over three times as much. The falling off for the South Shore dock is in about the same proportion. In May last year at the L. S. & I. dock 56 steamers were dispatched, or an average of nearly two a day. The number loaded and cleared last month was only 17. Heavy quantities of ore in the furnace yards and a comparative lull in the iron market are given as the reasons for the marked falling off in the shipments from the upper Lake ports. Though conditions in Marquette may be slightly exaggerated as compared with some other ports, all are materially behind last year's shipments on Apr. 1, and though the amount of ore on the lower Lake docks was not materially greater than a year ago, the stocks in the furnace yards were reported heavy.

HOUGHTON, MICH.—June 6

Mohawk Will Show a Production of 1,230,000 lb. of refined copper for June and 1,100,000 for May, judging from careful estimates and assuming that the present status is maintained during June. In April, Mohawk sent down 48,913 tons of rock, securing therefrom 1,631,500 lb. of mill copper, showing 33.35 lb. per ton and 1,191,225 lb. refined copper, showing 24.35 lb. per ton. At present this average is maintained. Every underground facing is in rock, which is promising. June production, though it will show a slight increase, will be nothing sensational. More important to the future of the property is the fact that underground work is keeping openings further in advance than ever before. Mohawk is in position to increase output 10% when the market warrants such a step.

Copper Metal on Hand in the Lake Superior smelting plants at this writing does not aggregate 30,000,000 lb. Some of the Michigan copper mines have small amounts stored in New York warehouses, but practically none abroad. The total amount stored is just one month's output of the mines of this district, operating under normal conditions.

Calumet & Hecla and subsidiary mines have the greatest amount on hand, a total of 20,000,000 lb. This is the combined total showing at the Calumet & Hecla plant at Hubbell and the Lake Superior Smelting Co.'s plant at Dollar Bay, the subsidiary plant.

The Lake Superior plant was shut down 10 days ago, and all smelting hereafter will be done at Hubbell. A substantial amount of mass copper which was on hand at Dollar Bay was reshipped to Hubbell for treatment. Whether the Dollar Bay plant will be reopened when conditions improve again or not is a question which will be determined by the future product of the Calumet & Hecla mines. Since the opening of navigation, shipments of metal have been heavy and practically all of the copper has been sent out to fill urgent orders.

Shaft-Sinking at the Mayflower-Old Colony has reached 1250 ft., but progress is slow compared with the record for sinking at the Seneca property. However, conditions have been different, and there was not the same occasion for haste, although the progress at the Mayflower-Old Colony shaft has been economical and efficient. The general impression that this shaft will cut the Kearsarge amygdaloid lode is erroneous. The drill cross-section, as well as the geological history of the copper-containing lodes, indicates, a "throw" of the upheaval east of the Kearsarge and nearer the sandstone. There is reason to believe that the copper lode under the Mayflower-Old Colony shaft presents a mining situation which is different from any other lode in the district. The angle of the dip is likely to be smaller than any other. The Pewabic lode in the bottom of one of the Quincy shafts today dips only 20 deg., but the Mayflower lode will be nearer the horizontal than that. The present operating company is a combination of two corporations and has 200,000 shares outstanding. The consolidation was made 18 months ago, principally due to the fact that drilling results warranted the sinking of a shaft and that one exploratory shaft would suffice for the two companies.

JEROME, ARIZ.—June 4

Slag Dump of United Verde's old smeltery, above Jerome, has become a menace to the railroad development passing below its 300-ft. face, a section of the slag face having collapsed, covering the grade of the Verde Tunnel and Smelter R.R. on the 300 level. A steam shovel and workmen were removed just in time to avoid being caught by the avalanche. Measures now are being taken to bench the slag face, to guard against further slides.

BISBEE, ARIZ.—June 4

Operation of "Safety-First" Rules is credited with the reduction of the percentage of permanent injuries per 1000 men among Copper Queen employees from 1.05 in 1915 to only .43 two years later. The men themselves have become interested in the maintenance of the safety rules, which now have become almost self-enforcing. It is recognized that carelessness on the part of a fellow employee may imperil the safety of an entire stoping crew.

Stripping Overburden on Sacramento Hill is about 40% completed, about 2,000,000 cu. yd. thus far having been handled by the steam shovels and trammed off to fill valleys near by, about 80 trainloads a day thus being disposed of. So much work remains to be done that the 5000-ton concentrator near Warren, though construction was stopped by the war, probably will be ready for work as soon as an ample ore supply for it has been developed and made ready for shoveling. Eventually, where the hill stands, a short distance below the main business section of the camp, there will be a great pit, embracing the whole width of historic Mule Pass, involving diverting elsewhere of the railroad and highway by which Bisbee is entered from the south.

Men are being added slowly to the operating forces of the Copper Queen and Calumet & Arizona properties, which now have about 3000 employees. A large proportion of the men taken on are returned soldiers. Only a few hundred men, mainly Mexicans, remain out of employment. Few of them are miners.

JOPLIN, MO.—June 6

Operation of the Picher Hospital has been undertaken by the mining operators of the Oklahoma section of the field. The companies are contributing $10 per month, and this, with the 25c. per man assessment against the miners, is expected to keep the institution going. The plan is similar to the one worked successfully in the case of the Jane Chinn Hospital, at Webb City, Mo., which has been operated by mining men for two years.

One Thousand Acres of Mineral Leases have been taken by W. L. D. Martin, of western Kansas, formerly a mine operator in this district, in the vicinity of Jay, Okla., about 40 miles south of Miami, Okla. He will start immediately prospecting for zinc, lead and copper. Mr. Martin has rich outcroppings of these minerals that he found about 40 years ago, but which he could not develop at that time because no mining leases on Indian lands were then being granted by the Government.

Continued Efforts to Increase the Uses of Zinc are being made by the business men and commercial clubs in this district. The Central Foundry is putting a sheet zinc roof on its new foundry building in Joplin. The business men of Miami are offering a prize to the first company or institution that will put on a zinc roof in that town. A new sanitary dinner pail has been invented by a Baxter man, which will be made of zinc and will have a ventilation apparatus calculated to keep the food in a more edible condition than is possible with the common types of dinner pail.

FORT WORTH, TEX.—May 31

Public Highways cannot be leased by Commissioners' Courts to any one intending to drill them for oil and gas. In the case of C. H. Clark et al. vs. T. R. Boone et al. (the former 99 taxpayers of Wichita County and the latter members of the

Commissioners' Court of Wichita County) the district court rendered decision in favor of the plaintiffs. The decision was affirmed by Justice Irby Dunklin, of the Court of Civil Appeals for the Second Supreme Judicial District, on May 31, at Fort Worth, making the injunction against erecting a derrick or drilling machinery perpetual. The case originated when members of the Commissioners' Court of Wichita County leased part of the public highway near Burkburnett to be drilled for oil and gas. C. H. Clark and 98 other citizen taxpayers of the county obtained an injunction, claiming this act to be against public policy, on the grounds that land donated by citizens of a county to be used as a public highway did not carry a fee simple deed to the property, and did not deed away the mineral rights, if they existed.

AUSTIN, TEX.—May 29.

Pipe-Line Companies operating in Texas were ordered by the Railroad Commission, under the act placing the pipe lines within the jurisdiction of the Railroad Commission, to file a written monthly report showing all expenditures for investments and operations, and operating revenues; also an annual report for the year ended Dec. 31, 1918, and each year thereafter.

BIRMINGHAM, ALA.—June 5

Figures for May Production and selling of iron are not yet released, but it is believed they will show a considerable gain over those for April. Particularly is this true for sales, the Woodward Iron Co. alone shipping between 10 and 20 cars a day, with promise of this being increased. The renewed activities of this company are particularly pleasing to this district, as the company employs a large part of the labor here, and the almost complete shutdown of its plants caused much concern. The company began work again during May and is rapidly renewing all operations. The third furnace at Woodward and one of the Vanderbilt furnaces near East Birmingham will be blown in soon. This will make four of the five furnaces of this company in operation, and, as a result, operations at ore mines, coke ovens, and limestone quarries will be increased to produce the raw material needed in the manufacture of iron. This in turn will provide employment for a considerable part of the labor in this district said to be surplus, though some companies are reporting no surplus.

It is expected a large tonnage of iron ore will be produced soon from the Woodward company's shaft mine, development of which is being pushed.

All six furnaces of the Tennessee Coal, Iron & R. R. Co. at Ensley, Ala., are now in blast and also two of the five at Bessemer, one on ferromanganese and the other producing basic iron.

In general the iron situation for Alabama at the close of May was far brighter than at any time during the present year. Many inquiries for pig iron are coming in and numerous small sales recorded.

ANYOX, B. C.—May 30

Another Advance in the Wages of employees of the Granby Consolidated Mining and Smelting Co. was announced recently at its smelting centre, Anyox. It amounts to 50c. a day to miners and 25c. a day to smelter men and others, approximately 1200 men being affected. This is in addition to a 25c. raise a day for every 2c. increase in the selling price of copper. Wages have been increased about $1 a day since Apr. 1, when the plant reopened after being suspended for about thirty days.

TORONTO, ONTARIO—June 7

Development of the West Shining Tree gold area, which is attracting much attention at present, will be considerably encouraged by the completion of the road which is being built to the camp by the Ontario government. It was begun some time ago, when the foundation for a good automobile road was laid. Work has been resumed, and it is expected that the road will be completed within two months, when the trip from the railroad can be accomplished in two hours.

Demands Presented to Mine Operators by the miners belonging to the Kirkland Lake branch of the International Mine, Mill and Smelter Workers' Union asking for a 44-hour week at the same wages as are paid for the present 48-hour week, recognition of the union and a minimum wage of $4.50 per day for all underground workers. The operators are asked for a reply within 10 days from May 27. The general feeling among the mine managers is that in view of the economic conditions affecting the gold-mining industry, the demands cannot be granted. Similar action has been taken by the miners at the Porcupine and Cobalt camps.

The Mining News

ARIZONA

Cochise County

DENN-ARIZONA — (Bisbee) — Further exploration of strike of copper ore cut for 35 ft. on 1700 level suspended until extraordinary flood of water which has filled workings to 1600 level can be controlled.

Gila County

AZTLAN—(Chilito)—New gold strike in southern point of county, north of Winkelman. Hiram Whitcomb, of Tucson, has control of group and has secured capital for development and building of 100-ton mill and cable tramway to Arizona Eastern R. R., on Gila River, five miles distant.

PORPHYRY CONSOLIDATED—(Globe)—Stockholders of Barney Copper Co. have approved consolidation with Porphyry, with nearly all stock represented at meeting in Globe. Winze to be sunk 200 ft. below 650 level, in expectation of passing into sulphides.

Mohave County

CATHERINE — (Kingman) — Development has fully defined fault in main vein, and funds are in treasury for large development work on three levels to 400 feet.

RURAL—(Kingman)—Preparing for installation of 100-ton mill, with electrical equipment. Bunkhouses for 50 men being built. Constructing new road for motor truck transporation. Rich wire silver taken from bottom of shaft. Situated at Mineral Park.

UNITED AMERICAN (Oatman)—Roadway completed to shaft, which is being equipped for sinking to 500 ft.

McCRACKEN — (Signal) — New mill given test run on silver-lead ores, with excellent results reported.

Pinal County

RAY-BROKEN HILL—(Ray) — Purchased from W. J. Graham controlling interest in Little Bobbie Co., securing nine claims into which development will be extended. Another adjoining group, the Tillman, also acquired. Consolidated property will be worked through long tunnel now being driven from creek level below Ray.

CALIFORNIA

Nevada County

WOOLSEY GROUP (Cherry Hill)—Extensive work planned on these gravel properties by V. Butters, F. C. Foote and W. T. Foote, of Long Beach.

BAKER (Graniteville)—Five-stamp mill to be in operation when work justifies.

ALLISON RANCH (Grass Valley)—Recently elected E. E. McMichael president, Scott Ennis vice-president, Henry H. Heilbron secretary, and C. H. Brockington superintendent. Upper levels being worked by lessees with good results.

SOUTH STAR COMPANY (Grass Valley)—George E. Freeborn, manager, reports finding of high-grade ore in vein of large dimensions, after long search.

ASBESTOS (Washington)—Preparing to ship products this season. Work can be prosecuted in summer only, because of necessity of keeping fiber dry.

Shasta County

GARFIELD MINING COMPANY (Old Diggings)—Acquired Garfield mine. Permitted to sell 20,100 shares at par, proceeds to be used in development and operation.

AFTERTHOUGHT COPPER (Redding)—Announced after inspection by principal owners that flotation plant and zinc plant will be put in operation. Ore carries gold, silver, copper and zinc.

Lassen County

GRAY MOUNTAIN (Westwood)—Development resulted in finding 6-ft. vein high-grade ore.

COLORADO

Clear Creek County

STANLEY — (Idaho Springs) — Being developed and operated under leasing system. All ground above Rood Adit level and south of Clear Creek leased to E. F. Viesselman, with exception of one block of ground on Stanley vein in Whale level, which is operated by John Symons. The Viesselman ground is being subleased. The Rood Adit level has been cleaned out to the breast, a distance of 3500 ft. Caved ground retimbered and new development work in progress. Body of commercial ore opened near Golden Link shaft, and regular shipments of high-grade silver-lead ore being made. Considerable milling ore shipped to local mills for concentration, and the concentrates sold to Idaho Springs sampler. Thomas & Co. operating lease on Hukill vein north of Clear Creek, and upper Hukill level being advanced northeasterly, with encouraging results.

San Miguel County

GOOD MINERS are in demand by most of the large mining companies operating in the vicinity of Telluride. Comfortable quarters and good wages are assured to about 200 miners.

DEWEY (Ophir Loop)—New raise being made on 4-ft. vein of commercial milling ore. W. S. Carhart, superintendent.

COLORADO VANADIUM CORPORATION (Sawpit)—Acquired Simmons mill and will remodel it for the treatment of vanadium ore. Construction of new mill on San Miguel River below Fall Creek under consideration. Frank G. Gardner, manager.

PRIMOS CHEMICAL CO. (Vanadium)—New mill is under construction. Part of structural steel work erected. During construction of new plant underground development continues.

IDAHO

Shoshone County

NABOB (Beeler)—Expect 150-ton concentrator to be completed and running in 30 days. Small force working in mine preparatory to supplying mill with ore. Large oreshoot proved in Denver claim and considerable ore available in Nabob. Controlled by Stewart Mining Company.

COPPER KING (Mullan)—Contracted for 1000 ft. prospecting work with diamond drill. Will determine extent of present orebody and prospect virgin ground to north.

NATIONAL (Mullan)—Shipped 15 carloads concentrates in May, averaging 15% copper and 40 oz. silver. Net value of shipments about $70 per ton. Started work on 800 and 600 levels, above main working tunnel, where shoot of higher-grade ore has been found.

SUCCESS (Wallace)—Lessees on upper workings shipped five carloads lead concentrates. Working on body of lead and zinc ore between 700 and 600 levels. Have 200 tons of 40% zinc concentrates. No profit in shipping them at present price, owing to excessive freight rates and smelter charges.

MICHIGAN

Gogebic Range

TILDEN (Bessemer)—Oliver Iron Co.'s diamond drilling completed. Begun in June, 1917, with two machines; later another machine added. Drilled 14 holes from 243 to 1587 ft. deep, average being 601 ft. Six holes drilled from 21st and 23rd levels of No. 10 shaft. Depth of holes from 248 to

670 ft., average 492 ft. Most of drilling done with "E" bit, and cased. Casing usually blasted down, reaming done where blasting failed. Vugs, being hard rock and soft dikes, caused much trouble. Drilling results of geologic interest, although little new ore found. Surface holes situated 800 ft. or more from foot wall. Previous exploration by underground workings confined to area near foot wall.

TOWNSITE (Ironwood)—Now working two shifts again.

MINNESOTA

Cuyuna Range

CHESTER (Chisholm)—Has completed shipment of entire winter stockpile, about 70,000 tons. One of the first to accomplish this.

HULL-RUST (Hibbing)—Shipping 60,000 tons high-grade ore per 24 hours. A record even for this largest pit.

BONNIE BELLE (Ironton)—Shipping 200 tons per day to Zenith Furnace Co., Duluth. Iron ore producer of Marcus L. Fay.

KINNEY (Kinney)—Operating churn drills along north side of present pit development. Republic Iron and Steel Co., operator.

PILOT (Mountain Iron)—Cleaning ore preparatory to shipping.

FERRO (Trommald)—Loaded from stockpile and shipped 5000 tons manganiferous ore sold to Algoma Steel Company.

MISSABE MOUNTAIN (Virginia)—Oliver Iron Mining Co. check-drilling considerable portion of property.

OMAHA IRON COMPANY (Woodrow)—Operating Wilcox mine. Issued $250,000 bonds, of which $150,000 have been sold to make necessary improvements, and for development and working capital. Balance of $100,000 will be sold if needed. Underground iron-ore producer, ore being dried before shipment. Has 10-year contract for ore at rate of 100,000 tons per year; other contracts pending.

MONTANA

Broadwater County

INDIAN CREEK PLACERS (Hassel)—Sluicing 50-ft. gravel bank with hydraulic and bedrock flume. Water at low stage.

IRON MASK (Hassel)—Driving 2000-ft. crosscut tunnel to ore vein. Air compressor driven by gasoline power.

JUMBO (Hassel)—New company takes over old silver-producing property at the headwaters of Indian Creek, and will reopen it.

Jefferson County

LEGAL TENDER (Clancey)—New owners in control. Shaft to be deepened below 500-ft. level and electric power to be installed. High-grade silver ore.

Lewis and Clark County

HELENA (Helena)—Prospecting vein at 400 level with north-south drifts. May sink to 500 level soon.

STEMWINDER (Helena)—New hoist and pump received. Ore carries high silver content.

WHITLATCH (Helena)—Lessees working on 400 level; drifting west on vein, with showing of ore in sight.

Silver Bow County

ANACONDA (Butte)—Drifts easterly and westerly on the 500 of the Anglo-Saxon fissure in Orphan Girl mine continue in milling ore, and shipments to the Washoe concentrator daily are more than 100 tons. Indicated tonnage thus far is heavy, vein being about 50 ft. wide, with orebody about 35 ft. in width. Drift on 500 of Orphan Girl fissure entering mineralized zone appears of considerable promise. Orphan Boy vein, on same level, and also in Orphan Girl mine, showing about 3 ft. silver-zinc ore of good grade.

Concreting Diamond shaft begun in accordance with shaft fireproofing plans for company's 50-odd air and working shafts in district. Scarcity of miners resulting in decision to suspend mining operations at this property, one of the larger copper producers, and embrace the opportunity for improvement work, which will require several months' time. Badger State, one of the largest mines, resumed operations recently after about a week's shutdown in consequence of engine trouble. Endeavoring to speed up on development work, but difficulty in securing experienced miners handicapping the effort. Production around 55%, but indications that this may be increased within a short time.

BUTTE & SUPERIOR (Butte)—Sinking No. 2 shaft will be under way soon, preparatory to carrying all workings to lower levels. Ore showing east in Four Johns on the 1800 in large tonnage with grade, 17% zinc, 6 oz. silver as general average of mill heads. Shoot showing 8 ft. ore going more than 50% zinc and 20 oz. silver east on 1900 is continuing. Quarterly report for period ending Mar. 31 shows deficit after taxes of $116,379, as compared with profits of $96,506 for preceding quarter and $327,981 for first quarter of 1918. May production 10,000,000 lb. of zinc in concentrates, and 210,000 oz. silver. Tonnage mined, 35,400, from which concentrate recovery was 9250 tons, with the mill saving 97%. Angus McLeod, superintendent.

SOUTH DAKOTA

Pennington County

NATIONAL TIN CORPORATION (Hill City)—Has purchased three carloads machinery to add to equipment, including one 550-ft. Norwalk compressor, air tank, and two dreadnaught drills; one 40-hp. boiler for prospecting on Mohawk shaft; eight Isbell vanners, seven Wilfley tables, and one 5 x 4 ft. ball mill, with three tons of balls. Cowboy shaft unwatered, and being widened to make it double compartment. Being deepened to follow the ore which parallels it, and will contract for additional 500 ft. Foundations for ball mill will be started in the coming week, and also for installation of concentrators. Intend to crush with present rolls and to use the jigs, after which sands will be reground and classified on Wilfley roughing tables, then to fine Wilfleys and vanners. Fine slimes from Wilfleys and vanners will go to canvas plant with 2000 sq. ft. surface. Concentrates will be smelted in present furnace, using carbon-monoxide method. Later, electric furnace may be installed if proves cheaper.

TEXAS

Bell County

BELL-LEON OIL CO. (Temple)—Recently organized; capitalization, $50,000. J. B. Dyess, of Belton, president. Has leases on 6000 acres near Summers; mill between Lampas and Saldado rivers. Eight other companies have holdings in this region. Financed by local capital.

NOLAN-BELL OIL CO. (Temple)—Contracted for building of derrick and will buy standard rig at once. Owns 1200 acres, five miles from Nolanville, west of Temple, on Santa Fe railroad.

Brazoria County

WEST COLUMBIA PRODUCTION for fourth week in May, 24,785 bbl. per day, as compared with 17,600 bbl. per day for previous week. Producing companies as follows: The Texas Co., 7400 bbl.; Gulf Production Co., 6400 bbl.; Crown Oil Co., 5000 bbl.; Humble Oil Co., 4950 bbl.; Sun Oil Co., 1000 bbl.; Hanicker Oil Co., 35 barrels.

FREEPORT SULPHUR CO. (Freeport)—Shipments of sulphur now being made to Galveston for export. Only ships of too great draft to enter channel at Freeport will be loaded at Galveston.

Crockett County

RYAN PETROLEUM CO., of Bartlesville, Okla., leased 20,000 acres near San Angelo. First test well will be sunk near Ozona.

Jefferson County

GULF PRODUCTION CO. (Beaumont)—McFadden No. 1 well came in flowing about 250 bbl. a day, even though not completed, oil pushing up past wash pipe left in well. Efforts to remove pipe abandoned temporarily, as wind carried oil in spray toward boiler. Main feature of interest is that well is producing from depth of 3000 ft., though pay oil first opened at Spindletop was 700 to 800 ft. deep. McFadden No. 2 well will be drilled 400 ft. south and 100 ft. east of No. 1 well.

THE TEXAS CO. (Beaumont)—Started drilling Fee No. 1 and Fee No. 2 at Spindletop.

Orange County

GUM OIL CO. (Orange)—All stock of company sold recently to New York men for $385,000. Consists of three leases in Vinton field, 10 miles east of Orange; five wells in operation.

Wichita County

TEXAS CHIEF OIL AND GAS CO. (Burkburnett)—Reported well brought in one and one-half miles north of Burk-waggoner extension, flowing 5000 bbl. high-gravity oil from depth of 1650 feet.

UTAH

Juab County

TINTIC SHIPMENTS week ended May 31 amounted to 137 cars and the total for the month—five weeks—to 704 cars, about 35,000 tons, of an estimated value of $1,100,000. This is compared with 597 cars in April and 584 in March. Production for first five months in 1919 was 3143 cars, estimated at 155,000 tons, of a value of about $4,050,000. There were 25 shippers.

CENTENNIAL-EUREKA—(Eureka)—Two drifts being run on 2000 level, 100 ft. below water level. Water taken care of by lifting to 1900 where lost in fissuring.

IRON KING—(Eureka)—Compressor on foundations and hoisting engine expected on ground soon. Power line being extended to shaft. Force working on iron ore underground.

OPHONGO—(Mammoth)—Reported work may be resumed here under lease to active Tintic interests.

COLORADO—(Silver City)—Promising fissure cut on 1900. Possible new source of ore.

Salt Lake County

SHIPPING SEASON, although beginning late owing to severe snowstorms in March and April, now in full force. Record of one day's shipment was 160 tons over the Little Cottonwood Transportation Co.'s narrow-gage line.

TAR BABY (Salt Lake)—New men in control. Directors, J. Martin Matsen, president; R. G. Savage, J. W. Brewer, A. P. Davidson, and W. N. Gundry.

Summit County

PARK CITY SHIPMENTS for May amounted to 2767 tons.

Tooele County

McKINLEY, DOOLEY-ST. CLAIR AND KELLEY GROUPS (Ophir)—Consolidation of above reported. Taken over by Nevada men. Part of ground adjoins Ophir Hill and part across canyon.

CANADA

Ontario

MILLER INDEPENDENCE—(Boston Creek)—Main vein cut by diamond drill at 103 ft. in hole about 150 ft. east from "D" shaft. Width of 16 ft. indicated, vein being highly mineralized.

McKINLEY-DARRAGH—(Cobalt)—Exploration program adopted for southeastern part of property, near where Nipissing has obtained satisfactory results.

OPHIR—(Cobalt)—Nipissing Mining Co. has dropped its option.

PETERSON LAKE—(Cobalt)—Annual shareholders' meeting took place in Toronto on June 2. Number of directors was increased from five to nine, the following being elected: W. A. Lamport, C. M. Nickel, D. E. Kennedy, C. B. Powell, M. G. McLean, and W. G. H. Browne, all of Toronto; J. E. Carter, Guelph; Irving L. Ernst and Max B. Borg, both of New York.

BALDWIN—(Eby Township)—Vein struck carrying free gold on 200-ft. level.

LEROY—(Gowganda)—Crew engaged on surface work; underground operations will be started soon.

KIRKLAND LAKE—(Kirkland Lake)—Accident in connection with electrical equipment temporarily interfered with milling. Considerable high-grade ore added to reserves.

TOUGH OAKES—(Kirkland Lake)—Ore reserves developed sufficient to keep mill running six to eight months. Management will concentrate on development, and mill will not be operated until late in summer.

FIDELITY—(Skead Township)—Vein opened on surface shows visible gold.

UNION NATURAL GAS CO—(West Dover)—No. 13 Trenton well struck gas and stated to be obtaining initial flow of 6,000,000 to 8,000,000 cu.ft. per day. No. 14 well reported producing about 5,000,000 cu. ft. These wells give promise of being large oil producers, but the provincial inspector has stopped further drilling, on account of the loss of gas that would result. Will probably be deepened into the oil-bearing stratum when the flow of gas decreases. Several other wells in area are producing oil and gas, the gas stratum being reached at a depth of from 2900 to 3100 ft. and oil at about 3,100 to 3,300 feet.

FOISEY CLAIMS—(West Shining Tree)—Optioned to E. J. Longyear Co., of Minneapolis, Minnesota.

The Market Report

SILVER AND STERLING EXCHANGE

June	Sterling Exchange	Silver New York, Cents	Silver London, Pence	June	Sterling Exchange	Silver New York, Cents	Silver London, Pence
5	4.6175	109⅛	53⅛	9	4.6350	109½	....
6	4.6213	109⅛	53⅛	10	4.6250	110⅛	53⅛
7	4.6213	109⅛	53⅛	11	4.6200	111⅛	54⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

June	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
5	16.60 @16.70	†72⅛	5.15 @5.25	4.90 @5.00	6.125 @6.15
6	16.80 @17.10	†72⅛	5.25	4.90 @5.00 4.95	6.15 @6.20 6.20
7	17.10 17.15	†72⅛	5.25 5.25	@5.00 4.95	@6.30 6.275
9	@17.35	†72⅛	@5.35 5.30	@5.00 4.975	@6.375 6.40
10	17.35	†72⅛	@5.35 5.35	@5.025 5.05	@6.50
11	17.60	†72⅛	@5.40	@5.10	6.50

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

June	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
5	78⅞	79⅛	81⅛	233½	229½	22⅜	23	35⅛
6	79⅛	79⅛	82	234	229⅜	22⅛	22	35⅜
7	....	....	....	....	....	....	....	....
9	....	....	....	....	....	....	....	....
10	80½	80⅜	83	235½	230⅜	22⅛	22⅛	36
11	79⅛	80⅛	83	236½	232⅜	22⅛	22⅛	36⅛

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—June 11, 1919

Copper, lead, and zinc were excited this week, and each advanced sharply in price. In each metal there was large speculative buying.

The silver market has steadied itself at about $1.09. Our London advices are that the Indian government will not buy silver at any price for the present and does not propose to raise the embargo on imports of silver into India. The silver question is being carefully considered in London, and strong efforts to check any further advance in price will surely be made.

Transatlantic freights and transpacific freights remain unchanged from the quotations of last week.

It has come to our attention that there was an error in the price of standard spot copper and three-months lead in London on May 7, as published in the "Journal" of May 10. The correct figures are as follows: Standard spot copper, £76⅜; three-months lead, £24⅜.

Also, on account of indistinct printing, a number of the London metal prices during May did not show up clearly. In order that the record may be correct the prices for the entire month are reprinted herewith.

LONDON

May	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
1	76	76⅛	80⅛	226⅜	226	24⅛	24	35⅛
2	75⅞	75⅞	80⅛	226⅛	225⅛	24⅛	24	35⅛
3	....	....	....	....	....	....	....	....
5	75⅞	76	80	226⅜	227	24⅛	24	35
6	76⅛	76⅛	80	227⅛	228	24	24⅛	34⅛
7	76⅛	76⅛	80	228⅛	228⅛	24⅛	24⅛	34⅛
8	76⅛	76⅛	80	229⅛	228⅛	24⅛	24⅛	34⅛
9	76⅛	77	80⅛	231⅛	229⅛	24	24⅛	34⅛
10	....	....	....	....	....	....	....	....
12	76⅛	76⅛	80⅛	236	233	24	24⅛	34⅛
13	76⅛	77⅛	80⅛	235	232⅛	24⅛	24⅛	35⅛
14	77⅛	77⅛	81	236	233⅛	24⅛	24⅛	35
15	77⅛	77⅛	81	237	234	24⅛	24⅛	35⅛
16	78	78⅛	81⅛	242	237⅛	24⅛	24⅛	35⅛
17	....	....	....	....	....	....	....	....
19	79⅛	79⅛	82	246⅛	242⅛	24⅛	24⅛	36
20	79⅛	79⅛	82	245	241⅛	24⅛	24⅛	36
21	79⅛	79⅛	82	239	237	23⅛	23⅛	36
22	79⅛	79⅛	82⅛	236	232⅛	23⅛	23⅛	36⅛
23	78⅛	78.85	82⅛	233⅛	229	23⅛	23⅛	36⅛
24	....	....	....	....	....	....	....	....
26	78⅛	79	82	236	230⅛	23⅛	23⅛	36⅛
27	79⅛	79⅛	82	237	231	23	23⅛	35⅛
28	79⅛	79⅛	82	235	230	22⅛	23	36
29	79⅛	79⅛	82	233⅛	229⅛	22⅛	23	36
30	78⅛	79	82	232⅛	229	22⅛	23	35⅛
31	....	....	....	....	....	....	....	....

In the "Journal" of June 7, the New York silver price of June 3 did not show clearly, owing to defective printing. The price on that day was $1.09⅛.

Copper—The market was excited right from the beginning of the week and advanced not only from day to day, but also from morning to afternoon. At the beginning of June 5, the market was on the basis of 16.60c., but by the end of the day it was firmly established at 16.70c. Considerable speculative buying began to be done, and England was reported reselling contracts, her price being lower than ours. On Tuesday the market became pretty steady on the basis of 17.35c., a rather large business being transacted, and before the end of the day 17.60c., or 17⅛c., delivered, was asked and received for some small quantities, but with June 11 the market could be called established on that basis.

The aggregate of business done during the week was fairly large, but in no way sensational. However, producers found it easy to advance their prices on relatively small business. Wire-drawers were buyers, but a considerable part of the business of the week was of purely speculative character.

It was supposed that the Japanese had finished their buying, but some further inquiries from that quarter appeared in the market. According to comparatively recent mail advices from London, the Japanese have paid cash there to cancel c.i.f. contracts.

The labor situation in this country is becoming threatening and is playing a part in the copper market. On the one hand, strikes among copper manufacturers in New England and New York are causing them to ask for delay in deliveries. On the other hand, the general situation as to labor in the Western mining and metallurgical districts is becoming critical. No higher wages than at present can be paid, but the present rates are insufficient to maintain the working forces.

Copper Sheets—The base price of copper sheets is 24c. per lb. Copper wire is quoted at 19⅛@19⅜c.

Tin—The balance of unsold stock on June 1, as reported by Mr. Armsby, was 1615 gross tons. From June 2 to June 7 sales were 544 tons, leaving 1971 as the balance on June 9.

Lead—The demand for lead in the middle West has been such that for some time the interior market has been out of joint with New York, where some liquidation of speculative lead was being made. Up to June 5 some cheap lead was still to be had in this market, but with June 6 all such offerings disappeared, and consumers who required some round lots had to pay the full price of 5.25c. Beginning with June 9 some large buying developed in the St. Louis market, while Western producers made sales for delivery at various places in the interior at prices considerably above the New York parity, following which some producers advanced their prices in New York. On June 11, 5.40c. was realized in the forenoon, and immediately afterward the American Smelting and Refining Co. advanced its price to 5.40c. This advance brought the New York market more nearly into line with St. Louis.

Zinc—The market advanced sharply from day to day on rather large business, which appeared to be mainly of a speculative character. The nature of the market was such that considerable irregularity was exhibited.

Zinc Sheets—The quoted price of zinc sheets is $10 per 100 pounds.

Other Metals

Aluminum—Virgin metal quoted at 33c. per lb. Unchanged.

Antimony—The market was steady at 8⅜@8½c. Futures were quoted at 8@8½c., duty paid, New York, for June-July shipment from the Orient.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Strong at $92. San Francisco telegraphs $88, firm.

Silver and Platinum

Silver—During the last week the silver market has been steady, with a rise on June 10 and a still further rise on the 11th to 54½d. in London and $1.11⅛ in New York. There has been a constant demand from buyers outside the London market, principally from the China banks, combined with orders from Scandinavian and South American countries. Sterling exchange has strengthened somewhat from the low figure of last week, and, although it has reacted lately, it has not dropped again to the previous low level.

Mexican dollars at New York: June 5, 84; June 6, 84; June 7, 84; June 9, 84⅜; June 10, 84⅜; June 11, 85⅛.

Platinum—Refined ingot was in good demand at $105.

Palladium—Strong at $120.

Zinc and Lead Ore Markets

Joplin, Mo., June 7—Blende, per ton, high, $43.90; basis 60% zinc, premium, $42; Prime Western, $42; sludge and flotation, $40@35; calamine, basis 40% zinc, $25@22. Average settling prices: Blende, $37.86; calamine, $22.72; all zinc ores, $37.54.

Lead, high, $64; basis 80% lead, $60@57.50; average settling prices, all grades of lead, $58.38 per ton.

Shipments the week: Blende, 9403; calamine, 195; lead, 1374 tons. Value, all ores the week, $440,620.

One smelting company, which has been a light buyer for several months, came into the market strong this week, contracting nearly 6000 tons on a $42 basis, just at a

time when all other buyers had decided prices must decline, following spelter downward. Two of the large mills of the Waco district closed down last Saturday, but others to be closed tonight will wait a little longer, hoping for a steadier ore market.

Platteville, Wis., June 7—Blende, basis 60% zinc, $44 base for premium grade, and $42.50 base for high-lead grade. Lead ore, basis 80% lead, $56 per ton. Shipments reported for the week are 1979 tons blende, 82 tons galena, and 274 tons sulphur ore. For the year to date the totals are 43,777 tons blende, 2168 tons galena, and 5806 tons sulphur ore. During the week 2639 tons blende was shipped to separating plants.

Other Ores

Manganese Ore—Some business in odd lots reported done at 50c. per unit for metallurgical ore.

Molybdenum Ore—Some business was reported done at 65@75c. for ore of good grade.

Tungsten Ore—A fair business reported done at about the same prices as last week.

Other Minerals

Pyrites—Spanish pyrites is quoted at 20c. per unit for furnace ore and 18c. for unbroken ore, c.i.f., New York or other Atlantic port. Unchanged.

Nitrates—The present Government price of nitrate of soda, fixed at $4.07½, is expected to drop to about $3.10 on June 30, when Government control will be removed.

Iron Trade Review

PITTSBURGH—June 10

Not much further improvement in the volume of steel orders has been observable in the last week, but in some lines there has been at least a little improvement. The most marked change is in merchant steel pipe, which now shows a demand not far below normal. Demand for oil-country goods continues excellent, and some mills have fallen behind in deliveries of lap-weld sizes, although running practically at capacity in lap-weld departments. In sheets there is some improvement. Plate and shape demand continues light, and merchant steel bars show moderate and unchanged demand.

The Steel Corporation's unfilled obligations decreased during May by 518,375 tons, or about 100,000 tons less than the average decrease in the four months preceding. Shipments amounted to about 800,000 tons, so that fresh bookings amounted only to about 300,000 tons. The unfilled tonnage reported, however, includes contract obligations, and during the month there were increased specifications against contracts, which meant a larger total booked in actual shipping orders than in preceding months, even though the figures relating to contract obligations appeared unfavorable.

The Valley market is quotable at Mar. 21 prices, except as to basic, which can be shaded 75c., the Valley market being: Bessemer, $27.95; basic, $25; foundry, $26.75; forge, $25.75, f.o.b. furnace, with $1.40 freight to Pittsburgh, but furnaces outside the Valleys would probably sell in Pittsburgh at delivered prices $1 to $1.50 less on basic iron and $1.50 to $2 less on foundry iron.

Steel—The billet market is almost absolutely dead, but there is a fair run of sheet-bar orders for nearby deliveries, at full prices in all or nearly all cases. The market remains quotable at Mar. 21 prices: Billets, $38.50; sheet bars and small billets, $42; slabs, $41; rods, $52.

Ferromanganese—The uncertainty as to prices at which English producers would sell ferromanganese is now in line to be ended, as some agents have authority to sell 80% alloy at $125, delivered consuming points. For some time it had been thought they would sell at £25, c.i.f., but there were claims that £30 was the regular price. Domestic makers continue their nominal quotation of $150. Resale material still makes the market, but is somewhat harder to find at previous quotations, $110@115, delivered. Spiegeleisen remains nominally at $33@35, delivered, for resale, 18%.

Coke—The market has been quiet, but each week coke producers have higher views as to what they want for second-half furnace coke. It is rumored that some Connellsville furnace coke can be had at $4 for second half, but operators insist they want much more, and are talking sliding scale contracts. Eastern furnaces state that if they had to pay $4 for Connellsville coke they would take byproduct instead, there being two good sources of supply, Bethlehem and the new Midvale operation, about completed. Spot furnace coke is now fairly firm at $4 per net ton at ovens, spot foundry being $4.50 @5, depending on grade.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	101.125	37.742	42.792	48.027
Mar.	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	101.125	36.963	47.215	48.886
May	74.745	99.505	107.135	37.940	48.980	52.104
June	76.971	99.500		39.065	48.875	
July	79.010	99.625		40.110	48.813	
Aug.	85.407	100.292		43.418	49.077	
Sept.	100.740	101.125		50.920	49.500	
Oct.	87.332	101.125		44.324	49.500	
Nov.	85.891	101.125		43.584	48.969	
Dec.	85.960	101.125		43.052	48.492	
Year	81.417	96.772		40.851	47.516	

New York quotations cents per ounce troy, 999 fine London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	16.763	110.000	78.700	125.000	95.700
Mar.	23.500	14.856	110.000	76.821	125.000	82.071
April	23.500	15.246	110.000	77.300	125.000	82.200
May	23.500	15.864	110.000	77.767	125.000	81.227
June	23.500		110.000		125.000	
July	25.904		119.913		134.913	
Aug.	26.000		122.000		137.000	
Sept.	26.000		122.000		137.000	
Oct.	26.000		122.000		137.000	
Nov.	26.000		122.000		137.000	
Dec.	(a)		118.447		133.167	
Year	24.628		115.530		130.507	

(a) No Market.

Tin	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248.557
February	92.000	66.801	311.525	223.963
March	(a)	67.934	318.875	236.843
April	(a)	72.500	329.905	225.275
May	(a)	72.500	364.217	234.398
June	(a)		331.925	
July	(a)		360.347	
August	(a)		380.900	
September	(a)		343.905	
October	(a)		335.543	
November	(a)		323.550	
December	(a)		267.736	
Av. year	(a)		330.138	

(a) No average computed.

Lead	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	5.226	7.091	4.992	29.00	27.952
April	6.772	4.982	6.701	4.722	29.00	24.888
May	6.818	5.018	6.704	4.773	29.00	23.852
June	7.611		7.511		29.00	
July	8.033		7.750		29.00	
August	8.050		7.750		29.00	
September	8.050		7.750		29.00	
October	8.050		7.750		29.00	
November	8.050		7.750		31.20	
December	6.564		6.324		40.00	
Year	7.413		7.222		30.10	

Spelter	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.836	7.272	7.661	7.922	54.000	56.045
February	7.814	6.623	7.639	6.273	54.000	46.150
March	7.461	6.500	7.286	6.150	54.000	38.500
April	6.890	6.465	6.715	6.114	54.000	36.118
May	7.314	6.429	7.114	6.079	54.000	35.477
June	8.021		7.791		54.000	
July	8.688		8.338		54.000	
August	8.985		8.635		54.000	
September	9.442		9.092		54.000	
October	8.801		8.451		54.000	
November	8.491		8.141		54.100	
December	8.163		7.813		56.050	
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.25	32.54	33.95	31.40	33.95	29.12
April	36.15	29.35	32.95	27.15	33.95	28.15
May	36.20	29.35	33.00	27.15	34.00	28.15
June	36.36		33.16		34.16	
July	36.60		33.40		34.40	
August	36.60		33.40		34.40	
September	36.60		33.40		34.40	
October	36.60		34.40		35.40	
November	36.60		34.40		35.40	
December	36.60		34.40		35.40	
Year	$36.67		$33.70		$34.45	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.† June 10	
Alaska Gold M.	3⅛
Alaska Juneau	2
Am.Sm.&Ref.,com.	83⅛
Am.Sm. & Ref., pf.	106
Am.Sm.Sec., pf., A	93
Am. Zinc	24⅛
Am. Zinc, pf.	62
Anaconda	73
Batopilas Min.	1⅛
Bethlehem Steel	88
Butte & Superior	29⅛
Butte Cop. & Zinc	13⅛
Cerro de Pasco	51⅛
Chile Cop.	26⅛
Chino	46⅛
Colo. Fuel & Iron	49
Crucible Steel	92⅛
Crucible Steel, pf.	99
Dome Mines	14⅛
Federal M. & S.	14⅛
Federal M. & S., pf.	44
Great Nor., ore ctf.	46⅛
Greene Cananea	44
Gulf States Steel	66⅛
Homestake	86
Inspiration Con.	59⅛
International Nickel	28⅛
Kennecott	39⅛
Lackawanna Steel	86
Mexican Petrol.	187⅞
Miami Copper	28⅛
Nat'l Lead, com.	82
National Lead, pf.	108
Nev. Consol.	19⅛
Ontario Min.	8⅛
Ray Con.	24⅛
Republic I.&S.,com.	89⅛
Republic I.&S., pf.	104⅛
St. Joseph Lead	14⅛
Sloss-Sheffield	65
Tennessee C. & C.	14
U. S. Steel, com.	108⅛
U. S. Steel, pf.	116⅛
Utah Copper	87⅛
Va. Iron C. & C.	68
Worthington Pump	80⅛

BOSTON CURB* June 10	
Boston Ely	2
Boston & Mont.	.76
Butte & Lon'n Dev.	.17
Calaveras	1⅛
Chief Con.	3⅛
Contact	.05
Cortes	.20
Crown Reserve	.25
Crystal Cop.	.12
Eagle & Blue Bell	2⅛
First Nat. Cop.	1⅛
Gadsden Cop.	⅜
Houghton Copper	1
Intermountain	‡.05
Iron Blossom	.38
Iron Cap.	10⅛
Majestic	.30
Mexican Metals	.22
Mines of America	‡.05
Mojave Tungsten	.12
Nat. Zinc & Lead	.10
Nevada-Douglas	.15
New Baltic	1½
Oneco	1
Pacific Mines	‡.25
Rex Cons.	.14
Yukon Gold	.75

SAN FRAN.* June 3	
Alta	‡.08
Andes	‡.30
Best & Belcher	‡.20
Caledonia	‡.24
Challenge Con.	‡.03
Confidence	‡.25
Con. Virginia	‡1.95
Gould & Curry	‡.10
Hale & Norcross	‡.25
Jacket-Cr. Pt.	‡.20
Mexican	‡.52
Occidental	‡.40
Ophir	‡1.55
Overman	‡.10
Savage	‡.20
Sierra Nevada	‡.15
Union Con.	‡.35
Utah Con.	‡.04
Belmont	3.50
Jim Butler	.36
MacNamara	1.00
Midway	.37
Mcnt.-Tonopah	‡.20
North Star	.10
Rescue Eula	.17
West End Con.	2.10
Atlanta	.04
Booth	.09
Comb. Frac.	.04
Florence	.43
Jumbo Extension	.12
Kewanas	.03
Nevada Hills	.05
Nevada Packard	.20
Round Mountain	.39
Silver Pick	.07
White Caps	.19

COLO. SPRINGS* June 3	
Cresson Con.	4.31½
Doctor Jack Pot	.03½
Elkton Con.	.05
El Paso	.18
Gold Sovereign	‡.02
Golden Cycle	1.67
Granite	.14
Isabella	.04½
Mary McKinney	.07½
Portland	.98½
United Gold M.	.15½
Vindicator	.32

BOSTON EXCH.† June 10	
Adventure	1½
Ahmeek	79½
Algomah	.80
Alloues	44½
Ariz. Com.	15
Arnold	‡.20
Bingham Mines	9¼
Bonanza	‡.20
Butte-Balaklava	.65
Calumet & Aris.	69½
Calumet & Hecla	420
Carson Hill	15
Centennial	17½
Copper Range	52½
Daly West	2½
Davis-Daly	7
East Butte	15½
Franklin	4½
Granby	76½
Hancock	7
Hedley	‡12
Helvetia	6
Indiana	1⅛
Isle Royale	38
Keweenaw	2
Lake	6
La Salle	3½
Mason Valley	5½
Mass	1½
Mayflower	10½
Michigan	6½
Mohawk	68⅛
New Arcadian	4
New Cornelia	21½
New Idria	9½
Nipissing	11⅛
North Butte	15
North Lake	1⅛
Ojibway	2½
Old Dominion	43
Osceola	58
Quincy	72
St. Mary's M. L.	63
Santa Fe	‡.25
Seneca	23½
Shannon	4
Shattuck-Ariz.	15⅛
So. Lake	3
So. Utah	.25
Superior	9
Superior & Bost.	4
Trinity	4
Tuolumne	1½
U. S. Smelting	68⅛
U. S. Smelting, pf.	49½
Utah Apex	3⅛
Utah Con.	11½
Utah Metal	2½
Victoria	4½
Winona	1⅛
Wolverine	23½

N. Y. CURB† June 10	
Am. Tin & Tung.	‡1
Big Ledge	‡⅛
Butte & N. Y.	‡
Butte Detroit	‡.03
Caledonia	.40
Calumet & Jerome	‡⅛
Can. Cop. Corpn.	1½
Carlisle	‡2
Cashboy	.08½
Con. Ariz. Sm.	1½
Con. Coppermines	6⅛
El Salvador	⅜
Goldfield Con.	.18
Goldfield Merger	‡.04½
Hecla Min.	5⅝
Howe Sound	‡½
Jerome Verde	‡⅛
Louisiana	‡⅛
Magma	37½
Marsh	.07
McKinley-Dar-Sa.	.60
Milford	‡.75
Mother Lode	.42
Nixon Nevada	.23
Ohio Cop.	.50
Rawley	‡2½
Ray Hercules	2½
Richmond	‡.50
Rochester Mines	.20
Standard S. L.	⅛
Stewart	.30
Success	‡.04
Tonopah	3⅛
Tonopah Divide	8⅛
Tonopah Ex.	2
Tribullion	‡.25
Troy Arizona	‡.10
United Eastern	4⅛
United Verde Ext.	.40½
United Zinc	‡.25
Utica Mines	‡.08

TORONTO* June 10	
Adanac	.18
Bailey	.03
Beaver Con.	.42
Conlagas	2.60
Hargraves	.03
Kerr Lake	5.75
La Rose	.25
Lake Shore	1.00
Min. Corp. of Can.	1.50
Peterson Lake	.07
Teck-Hughes	.20
Temiskaming	.37
Trethewey	.40
Wettlaufer-Lor.	.03
Davidson	‡.68
Dome Exten.	.30
Dome Lake	.17
Hollinger	6.50
McIntyre	1.62½
Newray	.12½
Porcu. Crown	.25
Vipond	.18
West Dome	.12

*Bid prices. †Closing prices. ‡Last quotations.

Current Prices—Materials and Supplies

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	St. Louis	Chicago	San Francisco	New York Current	New York One Yr. Ago
No. 10	3.55	4.64	4.57	5.80	4.57	5.45
No. 12	3.60	4.69	4.62	5.75	4.62	5.50
No. 14	3.65	4.74	4.67	5.90	4.67	5.55
Black						
Nos. 18 and 20	4.15	5.24	5.17	6.75	5.17	6.25
Nos. 22 and 24	4.20	5.29	5.22	6.80	5.22	6.30
No. 26	4.25	5.34	5.27	6.95	5.27	6.40
No. 28	4.35	5.44	5.37	7.05	5.37	6.45
Galvanized:						
No. 10	4.70	5.79	5.72	....	5.50	6.70
No. 12	4.80	5.89	5.82	7.30	5.55	6.80
No. 14	4.80	5.89	5.82	7.30	5.60	6.80
Nos. 18 and 20	5.10	6.19	6.12	7.60	5.90	7.10
Nos. 22 and 24	5.25	6.34	6.25	7.75	5.05	7.25
No. 26	5.40	6.49	6.42	7.90	5.20	7.40
No. 28	5.70	6.79	6.72	8.20	5.50	7.70

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago Current	Chicago One Year Ago
Standard bessemer rails	$45.00	$65.00	$45.00	$65.00
Standard openhearth rails	47.00	67.00	47.00	67.00
Light rails, 8 to 10 lb	2.58½*	3.36*	2.83½*	3.36½*
Light rails, 12 to 14 lb	2.54*	3.09*	2.79*	3.09*
Light rails, 25 to 45 lb	2.45*	3.00*	2.70*	3.00*

* Per 100 lb.

TRACK SUPPLIES—The following prices are base per 100 lb. f. o. b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, ⅝-in. and larger	$3.35	$3.90	$4.27	$4.44	$5.65
Track bolts	4.35	4.90	5.17	Premium	6.65
Standard section angle bars	3.00	3.25	4.22	Premium	4.60

STRUCTURAL MATERIAL—The following are the base prices f. o. b mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill Pittsburgh	New York Current	New York 1 Yr. Ago	St. Louis	Chicago
Beams, 3 to 15 in	$2.45	$3.47	$4.195	$3.54	$3.47
Channels, 3 to 15 in	2.45	3.47	4.195	3.54	3.47
Angles, 3 to 6 in. ¼ in. thick	2.45	3.47	4.195	3.54	3.47
Tees, 3 in. and larger	2.45	3.52	4.195	3.54	3.47
Plates	2.66	3.67	4.445	3.54	3.67

STEEL SHEET PILING—The following price is base per 100l b. f. o. b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$2.55	$2.55	$4–5

RIVETS—The following quotations are per 100 lb.:

	Mill Pittsburgh	New York Current	New York One Year Ago	Chicago	St. Louis	San Francisco	Dallas
			STRUCTURAL				
½-in. and larger	$4.20	$5.05	$6.095	$4.72	$4.79	$6.70	$6.75
			CONE HEAD BOILER				
½ in. and larger	4.30	5.15	6.195	4.82	4.89	6.80	6.75
⅝ and ¾	4.45	5.30	6.345	4.97	5.04	6.95	6.90
⅞ and 1	4.70	5.55	6.695	5.32	5.29	7.30	7.15

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York and St. Louis
Galvanized iron rigging	+12½%
Galvanized cast steel rigging	7½%
Bright plow steel	35%
Bright cast steel	22½%
Bright iron and iron tiller	5%

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Cincinnati	Chicago	St. Louis	Denver	Birmingham
Straight	$5.75	$7.50	$6.50	$6.25	$8.50	$7.35
Assorted	....	7.50	6.50	6.40	8.75	7.60

BAR IRON AND STEEL—Per pound to large buyers at mill, Pittsburgh:

Iron bars 2.35c. Steel bars 2.35c.

COAL BIT STEEL—Warehouse price per pound is as follows:

New York	Cincinnati	Birmingham	St. Louis	Denver	Chicago
$0.12	$0.16½	$0.18	$0.19	$0.18½	$0.16½

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham	Denver
Solid	14c.	13c.	15c.	15c.
Hollow	21c.	14c.	...	20c.

STEEL AND IRON PIPE—The following discounts are for carload lots f. o. b. Pittsburgh, basing card of National Tube Co. for steel pipe, Cardry A. M. Byer's for iron, both dated Mar. 21, 1919.

Inches	Steel Black Per Cent.	Galvanized Per Cent.	Inches	Iron Black Per Cent.	Galvanized Per Cent.
	BUTT WELD				
¼ to 3	57½	44	¼ to 1¼	39½	23½
	LAP WELD				
2	50½	38	1½	24½	9½
2½ to 6	53½	41	1¾	31½	17½
7 to 12	50½	37	2	32½	18½
13 and 14	41	..	2½ to 6	34½	21½
15	38½	..	7 to 12	31½	18½
	BUTT WELD, EXTRA STRONG PLAIN ENDS				
¼, ⅜ and ½	46½	29	¼, ⅜ and ½	28½	11½
¾	51½	39	¾	33½	20½
¾ to 1¼	55½	43	¾ to 1¼	39½	24½
2 to 3	56½	44			
	LAP WELD, EXTRA STRONG PLAIN ENDS				
2	48½	37	1½	25½	10½
2½ to 4	51½	40	1¾	31½	17½
4½ to 6	50½	39	2	33½	20½
7 to 8	46½	33	2½ to 4	35½	23½
9 to 12	41½	28	4½ to 6	34½	22½
			7 to 8	26½	14½
			9 to 12	21½	9½

From warehouses at the places named the following discounts hold for steel pipe

	Black New York	Black Cleveland	Black Chicago
¼ to 3 in. butt welded	47%	46½%	57½%
3½ to 6 in. lap welded	42%	42½%	53½%

	Galvanized New York	Galvanized Cleveland	Galvanized Chicago
¼ to 3 in. butt welded	31%	31%	44%
3½ to 6 in. lap welded	27%	27½%	41%

Malleable fittings, Class B and C, from New York stock sell at list plus 15%. Cast iron, standard sizes, 10%.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Hot pressed square	$0.25	$1.00	$1.90	$1.40	$2.00	$1.05
Hot pressed hexagon	.25	1.00	1.90	1.20	2.00	.85
Cold punched square	2.25	1.00	1.90	.75	1.30	1.50
Cold punched hexagon	2.25	1.00	1.90	.75	1.30	1.50

Semifinished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	50–10%	40%
Chicago	50%	50%
Cleveland	60–10–10%	60%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	60%	50%	50–10%
Larger and longer up to 1 in. by 30 in.	50%	40%	40–10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York $2.00 Cleveland $3.00 Chicago $2.25
For cast-iron washers the base price per 100 lb. is as follows:
New York $6.00 Cleveland $3.75 Chicago $4.00

CONSTRUCTION MATERIALS

ROOFING MATERIALS—Prices per ton f. o. b. New York and Chicago:

	Carload Lots N. Y.	Carload Lots Chicago	Less Than Carload Lots N. Y.	Less Than Carload Lots Chicago
Tar felt (14 lb. per square of 100 sq.ft.)	$52.00	$52.50	$53.00	$53.50
Tar pitch (in 400-lb. bbl.)	19.00	16.00	20.00	17.00
Asphalt pitch (in barrels)	36.00	36.00	41.50	41.50
Asphalt felt	67.50	67.50	72.00	72.00

PREPARED ROOFINGS—Standard grade rubbered surface, complete with nails and cement, costs per square as follows in New York, St. Louis, Chicago and San Francisco:

	1-Ply c.l.	1-Ply l.c.l.	2-Ply c.l.	2-Ply l.c.l.	3-Ply c.l.	3-Ply l.c.l.
No. 1 grade	$1.35	$1.60	$1.70	$1.95	$2.05	$2.30
No. 2 grade	1.20	1.45	1.50	1.75	1.80	2.05

Asbestos asphalt-saturated felt (14 lb. per square) costs $5.00 per 100 lb.

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $1.80 per roll in carload lots and $2.05 for smaller quantities.

Shingles, red and green slate finish, cost $5.00 per square in carloads, $5.25 in smaller quantities, in Philadelphia.

HOLLOW TILE—

	4 x 12 x 12	8 x 12 x 12	12 x 12 x 12
St. Paul	$0.056	$0.11	$0.162
Seattle	.09	.175	.30
Los Angeles*	.082	.154	.236
New Orleans	.165	.22	.325

* F.o.b. factory, 4, 8 and 10 inch.

LUMBER—Price per M in carload lots:

	8 x 8-In. x 20 Ft. and Under				12 x 12-In. 20 Ft. and Under	
	P.	Fir	Hemlock	Spruce	P.	Fir
Boston	$46.50	$45.00	$45.00	$46.00	$52.00	$46.00
Kansas City	40.25	42.50	42.25	42.25	45.50	13.25
Seattle	20.50	20.50	20.50	20.50	20.50	20.25
New Orleans	35.50 (No. 1)				40.00 (No. 1)	
St. Paul	50.00	53.00	46.00	46.00	57.00	55.00
Denver	44.00	36.50	36.50		49.00	39.00
Atlanta	37.50				48.00	
Montreal		65.50		38.00		38.00
Detroit	40.00				45.00	

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir	Hemlock	P.	Fir
Boston	$50.00	$45.00	$40.00	$45.00	$48.50
Kansas City	52.75	50.75	59.75	55.00	66.00
Seattle	20.50	20.50	20.50	20.50	20.50
New Orleans	40.00			38.00	
St. Paul	51.50	47.00	40.00	51.00	46.00
Denver	45.00	35.50	35.50	38.00	32.00
Atlanta	33.00			33.00	
Los Angeles		36.00	35.00		
Montreal	60.00		45.00	60.00	

* Los Angeles: Base price of fir is $32; of hemlock, $34; redwood, $35.

NAILS—The following quotations are per keg from warehouse:

	Mill Pittsburgh	St. Louis	Dallas	Chicago	San Francisco
Wire	$3.25	$3.90	$4.75	$3.90	$3.90
Cut	4.45	6.00		5.50	6.00

PORTLAND CEMENT—These prices are for barrels in carload lots, without bags.

	Current	One Month Ago	One Year Ago with Bags
New York	$2.30	$2.45	$2.55
Jersey City	2.27	2.62	2.50
Boston	2.57	2.57	2.87
Chicago	2.00	2.05	2.36
Pittsburgh	2.05	2.15	2.71
Cleveland	2.22	2.32	2.84
Denver	2.67	2.67	3.20

Note—Charge for bags is generally 15c. each, 60c. per bbl.

LIME—Warehouse prices:

	Hydrated per Ton		Lump per 300-Lb. Barrel	
	Finished	Common	Finished	Common
New York	$17.50	$14.50	$2.90	$2.65
Kansas City	21.00			2.20*
Chicago	18.00	17.50	1.80*	1.10*
St. Louis	22.00	18.00		1.75*
Boston	22.50	18.25	3.65	3.30
Dallas	2.25	1.25*		
San Francisco	19.00			2.00†
St. Paul	23.00	19.50	1.60*	1.40*
New Orleans				1.65*
Atlanta		18.50		1.40*
Los Angeles			3.05†	2.80*
Denver		26.25		2.50*

* 200-lb. barrels. † Per 180-lb. bbl. ‡ Per ton.
Note—Refund of 10c. per barrel.

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw per barrel	$1.76	$1.55	$1.74	$1.65	$1.78	$1.65
5-gal. cans	1.89	1.65	1.90	1.80	1.98	1.75

WHITE AND RED LEADS in 500-lb. lots sell as follows in cents per pound

	Red				White	
	Current		1 Year Ago		Current Dry and In Oil	1 Yr. Ago Dry and In Oil
	Dry	In Oil	Dry	In Oil		
100-lb. keg	13.00	14.50	11.25	11.00	13.00	10.50
25- and 50-lb. kegs	13.25	14.75	11.50	11.25	13.25	10.75
12½-lb. keg	13.50	15.00	11.75	11.50	13.50	11.00
5-lb. cans	15.00	16.50	13.25	13.00	15.00	13.00
1-lb. cans	16.00	17.50	13.25	13.00	16.00	13.00

MINING AND MILLING SUPPLIES

HOSE—

	Fire
	50-Ft. Lengths
Underwriters' 2½-in.	70c. per ft.
Common, 2½-in.	40%

	Air		
	First Grade	Second Grade	Third Grade
¾-in. per ft.	$0.50	$0.35	$0.25

Steam—Discounts from List

First grade..... 30% Second grade..... 40% Third grade..... 40–10%

LEATHER BELTING—Present discounts from list in the following cities are as follows:

	Medium Grade	Heavy Grade
New York	35%	25%
St. Louis	45%	50%
Chicago	45%	40%
Birmingham	35%	35%
Denver	35–5%	30%

RAWHIDE LACING—30% off for cut; 62c. per sq.ft. for side lacing.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft. there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ¾-in., 8 ft., ½-in., 6; ⅝-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ¾-in. and larger, in 1200-ft. coils:

Boston	$0.25	Denver	$0.29
New York	.27	Kansas City	.28½
Cincinnati	.29	New Orleans	.27½
Chicago	.26½	Seattle	.27
St. Paul	.28	St. Louis	.26½
San Francisco	.26	Atlanta	.30

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$0.95
Asbestos for high-pressure steam	1.60
Duck and rubber for piston packing	1.00
Flax, regular	1.20
Flax, waterproofed	1.60
Compressed asbestos sheet	1.00
Wire insertion asbestos sheet	1.20
Rubber sheet	.60
Rubber sheet, wire insertion	.80
Rubber sheet, duck insertion	.50
Rubber sheet, cloth insertion	.30
Asbestos packing, twisted or braided and graphited, for valve stems and stuffing boxes	1.20
Asbestos wick, ½- and 1-lb. balls	.85

REFRACTORIES—Following prices are f. o. b. works, Pittsburgh:

Chrome brick	net ton	$120.00 at Chester, Penn.
Chrome cement	net ton	65.00 at Chester, Penn.
Clay brick, 1st quality fireclay	net ton	40–30 at Clearfield, Penn.
Clay brick, 2nd quality	net ton	38–48 at Clearfield, Penn.
Magnesite, dead burned	net ton	32.50 at Chester, Penn.
Magnesite brick, 9 x 4½ x 2½ in.	net ton	90.00 at Chester, Penn.
Silica brick	net ton	45–55 at Mt. Union, Penn.

Standard size fire brick, 9 x 4½ x 2½ in. The second quality is $4 to $5 cheaper per 1000.

St. Louis—Fire Clay, $35 to $50.
Birmingham—Fire clay, $40–$45; silica, $40–$50; magnesite, $90; chrome, $120
Chicago—Second quality, $25 per ton.

RAILWAY TIES—For fair size orders, the following prices per tie hold:

	Material	7 In. x 9 In. by 8 Ft. 6 In.	6 In. x 8 In. by 8 Ft.
Chicago	Plain	1.48	1.33
San Francisco	Douglas Fir—Green	1.35	.96
San Francisco	Douglas Fir—Creosoted	2.72	1.92

Prices per tie at Missouri mills; St. Louis prices about 25c. higher:

Untreated A Grade White Oak 6x8x8		Untreated A Grade Red Oak 6x8x8	
No. 1	$0.70	No. 1	$0.55
No. 2	.80	No. 2	.65
No. 3	.90	No. 3	.75
No. 4	.98		
7x9x8 white oak			1.05
7x9x8 red oak, No. 4	.80	No. 5	.87

FLOTATION OILS—Prices of oils for flotation, in cents per gallon, in barrels.

	New York	Chicago In Bbl.	Chicago Carloads	Denver
Pure steam-distilled pine oil, sp. gr. 0.925-0.94	$0.68	$0.71	$0.69	$0.81
Pure destructively distilled pine oil	.68	.68†	.66†	.53–.68
Pine tar oil, sp.gr. 1.02=1.035	.45	.36	.34	.40–.47
Crude turpentine	.51	.68	.66	.53–.63
*Hardwood creosote, sp.gr. 0.96–0.99	.24			.50–.57

* F.o.b. Cadillac, Mich.

COTTON WASTE—The following prices are in cents per pound:

	New York				
	Current	One Year Ago	Cleveland	Chicago
White	11.00 to 13.00	13.00	16.50	12.00 to 16.50
Colored mixed	8.50 to 12.00	10.00	13.00	11.50 to 14.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½ x 13½	13½ x 20½
Cleveland	$52.00	$58.00
Chicago	48.00	50.00

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25 lb. keg for black powder:

	Low Freezing 20%	Gelatin 40%	Gelatin 60%	Gelatin 80%	Black Powder
New York		$0.27½	$0.30		$2.40
Boston	$0.22½	.24½	.26½	$0.31	2.40
Cincinnati	.19½	.21½	.23½		2.35
Kansas City	.19	.23½	.26½	.30	2.45
New Orleans	.23½ (50%)	.22½	.24½		
Seattle		.18½	.21		
Chicago	.18½	.21½	.25½		
St. Paul	.19	.23½	.26½		2.45
St. Louis	.19	.23½	.25½	.30	2.35
Denver	.17½	22	.24½	.28½	2.60
Dallas	.189	225	228	342	
Los Angeles	.19	.24	.27		2.75

CHEMICALS

SODIUM CYANIDE—New York price is 30c. per lb.; Denver, 42c.; Chicago, 31½c.; St. Louis, 31c.

SODIUM SULPHIDE—In New York the price per pound is 4½c. for concentrated, 2c. for crystals. The St. Louis price is 6c. for 2½c. for crystals. The Denver price is 32c. The Chicago price is 6c. for concentrated, 3½c. for crystals. Concentrated comes in 500-lb. drums, the crystals in 440-lb. bbl.

ZINC DUST—For 350 mesh the New York price is 10c. per lb.; Chicago, 13c., Denver, 13c. St. Louis, 11c., less than car lots 12c.

ALUMINUM DUST—Chicago price is 1.30 per lb.; Denver, 40c.

MINERS' LAMP CARBIDE—Prices net f.o.b. cars at warehouse points.

	Union 100-Lb. Drums Per Ton	Cameo 100-Lb. Drums Per Ton	Union 25-Lb. Drum Per Drum
East of the Mississippi, North of Chattanooga	$106.00	$101.00	$1.52
Southeastern portion U. S. A.	115.50	110.50	1.63
Texas (except El Paso)	124.00	119.00	1.74
El Paso, Texas	126.00	121.00	1.77
Denver, Colo	124.00	119.00	1.74
West Coast	129.00	124.00	1.81